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Contributors who wish their articles to appear in the next number are requested to forward them before the 10th of July to the Editor,

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The following works have been received for review:

Medical Electricity: A Practical Treatise on the Applications of Electricity to Medicine and Surgery. By ROBERTS BARTHOLOW, A.M., M.D., LL.D., Professor of Materia Medica, General Therapeutics, and Hygiene, in the Jefferson Medical College of Philadelphia, etc. Third edition, enlarged and improved. Philadelphia: Lea Brothers & Co., 1887.

The Practitioner's Handbook of Treatment; or, the Principles of Therapeutics. By J. MILNER FOTHERGILL, M.D., Physician to the City of London Hospital for Diseases of the Chest, Victoria Park, etc. Third edition. Philadelphia: Lea Brothers & Co., 1887.

The Year-Book of Treatment for 1886. Philadelphia: Lea Brothers & Co., 1886.

The Nursing and Care of the Nervous and the Insane. By CHARLES K. MILLS, M.D., Professor of Diseases of the Mind and Nervous System in the Philadelphia Polyclinic. Philadelphia: J. B. Lippincott Co., 1887.

Maternity, Infancy, Childhood. Hygiene of Pregnancy; Nursing and Training of Infants; The Care of Children in Health and Disease. By JOHN M. KEATING, M.D., Visiting Obstetrician, and Lecturer on the Diseases of Women and Children, Philadelphia Hospital. Philadelphia: J. B. Lippincott Co., 1887.

Sphygmography and Cardiography. Physiological and Clinical. By ALONZO T. KEYT, M.D. Edited by ASA B. ISHAM, M.D., and M. H. KEYT, M.D. New York: G. P. Putnam's Sons, 1887.

The Diseases of the Ear, and their Treatment. By ARTHUR HARTMAN, M.D. Berlin. Translated from the third German edition by JAMES ERSKINE, M.A., M.B., Surgeon for Diseases of the Ear to Anderson's College Dispensary, Glasgow, etc. New York: G. P. Putnam's Sons, 1887.

Anatomy, Descriptive and Topographical, in 625 illustrations. By CARL HEITZMANN, M.D. English edition, by LOUIS HEITZMANN, M.D. New York: J. H. Vail & Co., 1887.

Agriculture in some of its Relations with Chemistry. By F. H. STORER, S.B., A.M., Professor of Agricultural Chemistry in Harvard University. In two volumes. New York: Charles Scribner's Sons, 1887.

Dermatitis Venenata: An Account of the Action of External Irritants upon the Skin. By JAMES C. WHITE, M.D., Professor of Dermatology, Harvard University Boston: Cupples & Hurd, 1887.

Dr. F. Beilstein's Lessons in Qualitative Chemical Analysis, Arranged on the Basis of the Fifth German edition. With copious additions, including chapters on Chemical Manipulations, Analysis of Organic Substances, and Lessons in Volumetric Analysis. By CHARLES O. CURTMAN, M.D., Professor of Chemistry in the Missouri Medical College, and in St. Louis College of Pharmacy. Second edition. St. Louis, Mo., 1886.

Physiological Laboratory. Harvard Medical School, Boston. Collected Papers, 1880–1886.

Public Health. The Lomb Prize Essays award made at the Thirteenth Annual Meeting of the American Public Health Association, Washington, D. C., December 10, 1885. With an Appendix. Second edition. Concord, N. H., 1886.

American Public Health Association, Lomb Prize Essays. Healthy Homes and Foods for the Working Classes. By VICTOR C. VAUGHAN, M.D., Ph.D., Professor in University of Michigan. Concord, N. H., 1886.

Elementary Microscopical Technology. A Manual for Students of Microscopy. In three parts. Part I. The Technical History of a Slide from the Crude Materials to the Finished Mount. By FRANK L. JAMES, Ph.D., M.D., President of St. Louis Society of Microscopists. St. Louis, 1887.

Dose and Price Labels of all the Drugs and Preparations of the Pharmacopœia of 1880. Together with Many Unofficinal Articles that are frequently called for as Medicines or used in the Arts. For the use of Pharmacists, Physicians, and Students. Second edition. By C. L. Lochman. Philadelphia, 1887.

Earth as a Topical Application in Surgery. By Addinell Hewson, M.D. Second edition. Philadelphia: The Medical Register, 1887.

The Hygiene of the Vocal Organs. A Practical Handbook for Singers and Speakers. By Morell Mackenzie, M.D. Lond., Consulting Physician to the Hospital for Diseases of the Throat. Third edition. London: Macmillan & Co., 1887.

A Text-book of Pathological Anatomy and Pathogenesis. By Ernst Ziegler, Professor of Pathological Anatomy in University of Tübingen. Translated and Edited for English students by Donald MacAlister, M.D., F.R.C.P. Part II. London and New York: Macmillan & Co., 1886.

On the Causation of Club-foot. By Robert William Parker, Surgeon to the East London Children's Hospital, etc. London, 1887.

Litholapaxy in Male Children and Male Adults. By Surgeon-Major D. F. Keegan, M.D. Dub., Bengal Medical Service, Residency Surgeon, Indore, Central India. London, 1887.

Hip Disease in Childhood. With special reference to its Treatment by Excision. By G. A. Wright, B.A., M.B. Oxon., F.R.C.S. Eng., Assistant Surgeon to the Manchester Royal Infirmary. London: Longmans, Green & Co., 1887.

Congenital Club-foot; its Nature and Treatment, with especial reference to the Subcutaneous Division of the Tarsal Ligaments. By Robert William Parker, Surgeon to the East London Hospital for Children, and to Grosvenor Hospital for Women and Children. London: H. K. Lewis, 1887.

The Royal London Ophthalmic Hospital Reports. Edited by R. Marcus Gunn, M.D., F.R.C.S. Vol. XI. Part III. January, 1887. London.

The Middlesex Hospital Reports of the Medical, Surgical, and Pathological Registrars for the year 1885. London: H. K. Lewis, 1887.

Transactions of the Obstetrical Society of London. Vol. XXVIII. for the year 1886. Part IV. for October, November, and December. London, 1887.

Hygiène des Maternités, Resultats de huit armées d'Observations à la Maternité de Pellegrin (Bordeaux). Par Dr. Oré, Professeur à la Faculté de Médecine, etc. Paris: J. B. Baillière et Fils, 1887.

Hysteries et Traumatisme Paralysies Contractures Arthralgies Hystero Traumatiques. Par le Dr. Paul Berbez. Paris: A Delahaye et Lecrosnier, 1887.

L'Amputation du Membre supèrieur dans la Contiguite du Tronc (Amputation Interscapulo-Thoracique). Par Paul Berger, Chirurgien de l' Hôpital Tenon. Paris: G. Masson, 1887.

M. Pasteur et La Rage. Par Dr. Lutaud, Rédacteur en Chef du Journal de Médecine de Paris. Paris: J. Lévy, 1887.

De l'Endométrite et de son Traitément. Par J. A. Doléris. Paris, 1887.

Hémorrhagies Utérines, par le Docteur Sneguireff; edition Française; redigée par M. H. Varnier, Interne des Hôpitaux de Paris, sous la direction de M. le Docteur Pinard, Professeur Agrégé a la Faculté de Paris. Paris: G. Steinheil, 1886.

Handbuch der allgemeinen und speciellen Arzneiverordnungslehre. Auf Grundlage der neuesten Pharmacopœen bearbeitet. Von Dr. C. A. Ewald, Professor an der kgl. Universität in Berlin. Elfte neu umgearbeitete und vermehrte Auflage. Berlin: August Hirschwald, 1887.

Die Gesundheitspflege in der Mittelschule. Von Dr. Leo Burgerstein in Wien. Wien: Alfred Holder, 1887.

The Influence of Maternal Impressions on the Fœtus. By Fordyce Barker, M.D., LL.D. New York, 1887.

Annual Address delivered before the American Academy of Medicine at Pittsburg, Pa., October 12, 1886. By R. S. Sutton, A.M., M.D.

Persistent Pain after Abdominal Section. By James B. Hunter, M.D. New York, 1887.

Operations for Phimosis as a Means of Cure. Relief of some Nervous and other Symptoms. By G. L. Magruder, M.D. Chicago, 1887.

The Uses of Massage in Medical Practice. Tracts on Massage translated from the German of Reibmayr, with Notes. By Benjamin Lee, A.M., M.D., Ph.D. Philadelphia, 1887.

Forensic Surgery. Wm. Zuppan *vs.* Wm. Dickinson, M.D. Verdict for Defendant. John D. Johnston, Esq., Counsel.

A Novel System of Operating for the Correction of the Deflected Septum by means of an Electric Motor Nasal Drill and an original Spray-producing device. With illustrative cases. By Wm. Chapman Jarvis, M.D. New York, 1887.

Evacuant Medication. Cathartics and Emetics. By Henry M. Field, M.D. Philadelphia, 1887.

Malarial Hemorrhage. Written by request of the Medical Society of Virginia. By Otis Frederick Manson, M.D., of Richmond, Va.

Some Observations upon the Modern Treatment of Urethritis. (Read by invitation before the New York

Dermatological Society.) By GEORGE E. BREWER, M.D., Assistant Surgeon to the Outdoor Department of Roosevelt Hospital. New York, 1887.

Researches into the Etiology of Dengue. By J. W. McLAUGHLIN, M.D., of Austin, Texas. Chicage, 1886.

Periostitis. By N. SENN, M.D., Professor of the Principles and Practice of Surgery and Clinical Surgery. Milwaukee, 1886.

The Antiseptic Treatment of Summer Diarrhœa. By L. EMMETT HOLT, A.M., M.D., Attending Physician to the New York Infant Asylum.

Abuse of Alcoholics by the Healthy. By STANFORD C. CHAILLÉ, A.M., M.D. Concord, 1886.

Iliac Phlegmons. Some Considerations of Anatomical and Surgical Interest. By RUDOLPH MATAS, M.D., 1886.

The Doctorate Address delivered at the Semi-centennial Anniversary of the University of Louisville, Medical Department. By DAVID W. YANDELL, M.D. March 2, 1887.

Dermatological Notes. By J. CLARK M'GUIRE, M.D., Dermatologist, Louisville City Hospital.

Address on the Duties and Conduct of Nurses in Private Nursing. By WM. L. RICHARDSON, M.D., Visiting Physician of the Massachusetts General Hospital. Boston, 1887.

The Question of Hemorrhage following Uvulotomy. By ETHELBERT CARROLL MORGAN, A.B , M.D., Washington, D. C., First Vice-President of the American Laryngological Association. New York, 1886.

A Contribution to the Study of the Operation of Shortening the Round Ligaments: Alexander's Operation. By THOMAS A. ASHBY, M.D. Baltimore, 1887.

Report of the Committee on Disinfectants, presented at the Fourteenth Annual Meeting of the American Public Health Association, held at Toronto, Canada, October 5–8, 1886. Concord, N. H., 1887.

Report of the Special Committee (appointed December 11, 1885) on the Disinfection of Rags. Presented at the Fourteenth Annual Meeting of the American Public Health Association, Toronto, Canada, October, 1886. Concord, N. H., 1887.

Maternal Impressions. Discussion on Dr. Barker's Essay. By SAMUEL C. BUSEY, M.D. Washington, D. C., 1887.

A New Explanation of the Renal Troubles, Eclampsia, and other Pathological Phenomena of Pregnancy and Labor. By A. F. A. KING, M.D. New York, 1887.

Thomson's Disease. Myotonia Congenita. By DR. GEO. W. JACOBY. New York, 1887.

Transplantation of a Rabbit's Eye into the Human Orbit. By CHARLES H. MAY, M.D. New York, 1887.

Practical Examples in Prescription Writing. By CHARLES H. MAY, M.D. New York, 1887.

Congenital Hæmophilia, with the History of a Remarkable Case. By EDWARD C. WENDT, M.D., February 19, 1887.

Some Considerations concerning Cancer of the Uterus, especially its Palliative Treatment in its later stages. By ANDREW F. CURRIER, M.D. New York, 1887.

Uterine Fibroids and other Pelvic Tumors; their Therapeutic Treatment and Conduct to the Menopause. By HENRY FRAZER CAMPBELL, M.D. 1887.

The Curability of Epilepsy and Epileptoid Affections by Galvanism and the Phosphated and Arsenided Bromides. January, 1887.

New Treatment of the Affections of the Respiratory Organs and of Blood Poison by Rectal Injections of Gases, after the Method of Dr. Bergeon. By DR. V. MOREL. Translated from the French by L. E. HOLMAN. Philadelphia: James W. Queen & Co.

Removal of the Uterine Appendages. Nine Consecutive Cases. By MARY A. DIXON JONES, M.D. New York, 1886.

Infants. Their Chronological Progress. By PROF. STANFORD E. CHAILLÉ, M.D., Tulane University of Louisiana.

Granular Conjunctivitis with and without Pannus. By W. CHEATHAM, M.D.

Proceedings and Addresses at a Sanitary Convention held at Big Rapids, Michigan, November 18 and 19, 1886, under the direction of a Committee of the State Board of Health and a Committee of Citizens of Big Rapids. Two books.

Report upon the Births, Marriages, and Deaths in the State of Rhode Island for the Year 1885. Prepared by CHARLES H. FISHER, M.D., State Registrar of Vital Statistics. Providence, 1886.

The Biennial Report of the State Board of Health of the State of West Virginia, for the years 1885 and 1886. Charleston, 1886.

The Report of the State Board of Health of Minnesota, 1884–1886, with Appendix containing Special Reports. Red Wing, 1887.

Report of the Board of Health for the City of Reading for the year 1886.

Report of the Commission for Better Provision of Insane Criminals. New York, February 16, 1886.

Annual Report of the Medical Superintendent of the State Asylum for Insane Criminals. Auburn, September, 30, 1886.

Annual Report of the Trustees of the Massachusetts General Hospital and McLean Asylum, 1886. Printed at the expense of the Bowditch History Fund. Boston, 1887.

Annual Report of the Cincinnati Hospital to the Mayor of Cincinnati for the fiscal year ending December 30, 1886. H. M. Jones, Superintendent. Cincinnati, 1887.

Transactions of the Pathological Society of Philadelphia. Vol. XII. Containing the Report of the Proceedings from September, 1883, to July, 1885. Edited by W. E. Hughes, M.D., Medical Registrar of the University Hospital. Philadelphia, 1886.

Transactions of the Massachusetts Medico-Legal Society. Vol. I. No. 9, 1886. Boston, 1886.

Proceedings of the Academy of Natural Sciences of Philadelphia. Part III. October–December, 1886. Philadelphia, 1887.

Transactions of the Seventeenth Annual Session of the Medical Society of Virginia, held at Fredricksburg, Va., September 26, 27, 28, 1886. Richmond, 1886.

The following Journals have been received in exchange:

Albany Medical Annals.
American Journal of Insanity.
American Journal of Obstetrics.
American Journal of Pharmacy.
American Journal of Science.
American Lancet.
American Medical Digest.
American Practitioner and News.
Annals of Surgery.
Archives of Ophthalmology.
Archives of Otology.
Atlanta Medical and Surgical Journal.
Boston Medical and Surgical Journal.
Buffalo Medical and Surgical Journal.
Chicago Medical Journal and Examiner.
Chicago Medical Standard.
Cincinnati Lancet and Clinic.
Cincinnati Medical News.
Cleveland Medical Gazette.
College and Clinical Record.
Columbus Medical Journal.
Daniels' Medical Journal.
Dental Cosmos.
Denver Medical Times.
Druggist's Circular.
Ephemeris.
Gaillard's Medical Journal.
Journal of the American Medical Association.
Journal of the Franklin Institute.
Journal of Nervous and Mental Diseases.
Kansas City Medical Record.
Kansas City Medical Index.
Maryland Medical Journal.
Medical Age.
Medical Herald.
Medical Press of Western New York.
Medical and Surgical Reporter.
Medical Record.
Mississippi Valley Medical Monthly.
Nashville Journal of Medicine and Surgery.
New Orleans Medical and Surgical Journal.
New York Medical Journal.
North Carolina Medical Journal.
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Pacific Medical and Surgical Journal.
Peoria Medical Monthly.
Philadelphia Medical Times.
Physician and Surgeon.
Pittsburg Medical Review.
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Texas Courier of Medicine.
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SARCOMA OF THE FEMALE BREAST;

BASED UPON A STUDY OF ONE HUNDRED AND FIFTY-SIX CASES.

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In my *Treatise on Tumors of the Mammary Gland,* published in 1880, may be found a chapter on sarcoma, in which the general pathology and life-history of the affection are deduced from an analysis of sixty cases confirmed by microscopical examination. This account remains up to the present time the most trustworthy description of this neoplasm with which I am acquainted; and it constitutes the only one in which an attempt has been made upon anything approaching an extended scale to determine the relations which exist between its minute features and its clinical characters. Feeling that many points were still obscure, I have, during the past seven years, kept a careful record of my own cases, and noted those reported by other surgeons, so that my collection now embraces one hundred and fifty-six cases,[1] including nineteen of my own, a critical examination of which affords the data for this paper.

The varieties and subvarieties of sarcoma of the female mamma are the same as those met with in other organs. The principal ones—the spindle-celled, round-celled, and giant-celled—are determined by the prevailing form of the cells, and the first two are further separated, in accordance with the dimensions of the cells, into the small-celled and large-celled. The subvarieties are constituted by the nature or arrangement of the intercellular substance; by various transformations or combinations with other neoplastic tissues; by the presence or absence of duct or retention cysts; and by the persistence of glandular elements. Hence the modified forms of sarcoma are the fibrous, lymphoid, alveolar, myxomatous, cartilaginous, osteoid, calcifying, melanotic, telangiectatic, hemorrhagic, cystoid, solid, cystic, and adenoid.

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[1] I have to express my thanks to Dr. Sands, Dr. Markoe, and Dr. Bull, of New York, and Mr. Bryant, of London, for unpublished cases from their practice, and to Mr. Henry Morris, of London, Mr. Humphry, of Cambridge, Mr. Banks, of Liverpool, Mr. Whitson, of Glasgow, and Mr. Page, of Newcastle-on-Tyne, for the final histories of their recorded cases.

Of the varieties of sarcoma, the spindle-celled, which include the fibrous, constitute 68 per cent., the round-celled 27 per cent., and the giant-celled 5 per cent. of all cases.[1] Of the subdivisions, 50 per cent. are cystic, the term including the barren and proliferous cysts; 50 per cent. are solid or noncystic; 33 per cent. are adenoid, the glandular structures persisting principally in the spindle-celled growths; 12.80 per cent. are myxomatous, the combination being almost peculiar to the spindle-celled and cystic tumors; 7.69 per cent. are telangiectatic and hemorrhagic; 7 per cent. are cystoid, or the seat of softening cysts; 2.56 per cent. are osteoid; 2.56 per cent. are calcifying; 1.21 per cent. are cartilaginous; 1.92 per cent. are alveolar; 1.21 per cent. are lymphoid; and 1.21 per cent. are melanotic or pigmented. It is interesting to note that in the ten examples of calcification, chondrification, and ossification, the tumors were spindle-celled in seven, and cystic in five. In the three cases of alveolar sarcoma the tumor was round-celled in two, and giant-celled in one; while both of the pigmented growths were alveolar and round-celled.

Like the other encapsuled neoplasms of the mamma, circumscribed sarcomata are ovoid, rounded, or spherical, lobed or bossed, and seldom smooth and uniform, the surface irregularities being most marked in the cystic variety. As a rule, they are unattached to the gland, but push it aside, compress, and flatten it, or cause it to atrophy, although they are, in rare instances, united to it by a pedicle. Their consistence varies with their minute structure and degenerations, the pure spindle-celled and giant-celled tumors being firm, like fibromata, while the round-celled are soft and elastic. The spindle-celled, however, are soft in about one-third of all examples, when they will be found to be composed of small fusiform cells, or to have undergone myxomatous or fatty transformation, or to be the seat of interstitial hemorrhage. The round-celled are hard in about one-sixth of all cases, when they will usually be found to be rich in fibrous intercellular substance. In one of the best illustrations of round-celled tumors that I have ever seen, the tissue was dense, so that they are by no means synonymous with soft, medullary, or encephaloid sarcomata, although they are usually much softer than the spindle-celled variety, since they are peculiarly rich in cells and bloodvessels, and since their intercellular substance is usually mucoid. The spindle-celled growths sometimes creak or cry under the knife, in which event they come under the category of fibrous sarcomata, from the large admixture of fibrous tissue. Their consistence varies, moreover, with their stage of development. If they are solid, it is entirely or almost uniform; while they are soft and elastic, or soft and fluctuating at some points, and especially at the larger bosses, and hard at others, when they are the seat of cysts occupied by fluid, or solid contents, or by both. In about one-fourth of the cystic growths, however, the tumor is firm throughout, in consequence of the cysts being so deeply seated as to elude detection by manipulation.

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[1] Of the nineteen cases that have come under my personal observation, thirteen were spindle-celled and six round-celled. Of the former, five were firm, small adenoid growths; one was a telangiectatic and myxomatous, and one a myxomatous medullary sarcoma; six were firm cystic, and in two of these the cysts were filled with vegetations. Of the six round-celled, one was lymphoid; one was a myxomatous cystic medullary growth; two were proliferous cystic, and one of these was medullary, and two were cystoid medullary tumors.

On section the spindle-celled tumors are usually smooth, succulent, and glistening, and of a white or grayish-white color, particularly if they are poor in vessels, the tint being rosaceous-white or rosaceous-gray when their vascular supply is larger. The round-celled tumors, on the other hand, are rarely pure white, but, from their relatively greater vascularity, reddish-white, reddish-yellow, or reddish-gray, the hue being not infrequently comparable to that of the fœtal brain. When they are highly vascular the rosaceous tint is very marked, or they are pervaded by macroscopic vessels; or dotted with minute spots of ecchymosis, or patches, or streaks of bright red or brown, or various intermediate shades of pigmentation. In not a few instances the soft brain-like tissue is so extensively interspersed with clots of blood, and with tomentous cysts containing blood, that the term hematoid or hemorrhagic sarcoma is not inappropriately applied to them, or the term fungus hematodes when they protrude through the skin. A pronounced yellowish color indicates fatty metamorphosis, which may pervade almost the entire tumor, or be confined to limited areas or to the vegetations alone, while the remainder is white or gray, thereby imparting to it a mottled aspect. A yellowish tint also denotes myxomatous changes, so that, as in the former instance, the mass of the growth may be white, or rosaceous-white, or rosaceous-gray, and the vegetations be yellow. On the whole, however, gelatinous spots dotting the surface of the section are the best characteristic of this change. Now and then, or when great vascularity and the fatty and myxomatous degenerations are combined, there will be areas of yellow and red, and spots of brown pigmentation, along with gelatinous dots. In point of fact, the color is so variable that it is extremely difficult to give an intelligible description of it. It need scarcely be added that melanotic sarcomata are pervaded by areas of dark brown or black pigmentation. The cut surfaces of many of the largest specimens have also a lobed appearance from the close packing of the vegetations in the enlarged ducts which play the part of capsules.

The gross characters of the smaller tumors, which correspond to the adenoid sarcomata of Billroth, and which do not grow larger than a walnut in seven or eight months, are worthy of notice, as they differ from fibromata of the same dimensions in several particulars that are useful in establishing a differential diagnosis. Thus, of the five specimens of adenoid spindle-celled growths which I have extirpated, all were lobulated, firm, elastic, adherent to the gland, grayish-white in color, and tough on section. The fibromata, on the other hand, were hard, merely nodular, less adherent to the mamma, white, and more compact and tough on section. Under the microscope, the glandular elements were undergoing obliteration to a greater extent in the former than in the latter.

Inflammation and suppuration of mammary sarcoma are infrequent, but ulceration of the overlying tissues is so common that it occurred in twenty-nine, or 18.59 per cent., of the one hundred and fifty-six cases that I have collated, a proportion which is more than double that met with in fibroma. As is witnessed in the latter tumor, the ulceration appears to be the result rather of inflammation and gangrene, or merely rupture, of the attenuated skin, than of its infiltration by sarcomatous cells; but in one case it depended upon exploratory puncture. In some examples it is, doubtless, due to invasion of the skin, but only one case, that of a crater-like ulcer, appears to have originated in this way. In 10 per cent. of the cases the ulcer presents itself in the form of a sloughing patch. Fungous protrusion almost invariably follows the perforation of the integuments, although in a remarkable instance recorded by Ashhurst,[1] the recurrent growth of which I exhibited at the Pathological Society, the ulcer subsequently healed. The protruding mass, which is usually an intracystic growth, varies in size from a hazelnut to three, four, and even five inches in diameter, and exhales a sanguinolent and fetid discharge, which may become more or less purulent from inflammation induced by exposure and friction. It is not, however, very prone to free hemorrhage or sloughing. The ulcer itself is usually circular, and the surrounding skin is not only, as a rule, free from discoloration, but it is also unattached to the fungus, and everted, or rather elevated, on its sides. Now and then there are several ulcers, separated by bridges of sound tissue. From a diagnostic standpoint, it is worthy of notice that ulceration occurred in 7.69 per cent. of solid sarcomata, against 18.76 per cent. of cystic sarcomata, and that it was met with in 25 per cent. of the giant-celled, 23.58 per cent. of the round-celled, and 17.58 per cent. of the spindle-celled tumors.

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[1] Trans. Path. Soc. Phila., vol. v. p. 230.

Sarcomata of the breast are generally solitary, since I find of one hundred and fifty-six cases that only ten were multiple, several growths existing in one gland in seven and in both glands in two, while in the tenth instance four tumors were present in one breast, and one tumor was found in its fellow. Their most common seat is in the vicinity of the nipple, and, when they arise from the circumference of the organ, they are usually found at its upper and outer quadrant. When of central origin they are, for the most part, cystic; while they are usually solid when they start from outlying lobules. In either event they evince a marked disposition to extend beyond the limits of their capsules, those of central origin gradually invading the entire gland, and the surrounding soft parts, while the peripheral ones not only infect the latter structures, but also finally implicate the entire breast. As a rule they give rise to broadly based hemispherical tumors, but they are now and then pedunculated.

They occur as early as the ninth and as late as the seventy-fifth year, the average age of their first observation being 40.6 years. Of 148 cases in which the age is recorded,

1	appeared	at	9 years.
14	“	between	10 and 19 years.
16	“	“	20 “ 29 “
40	“	“	30 “ 39 “
39	“	“	40 “ 49 “
23	“	“	50 “ 59 “
14	“	“	60 “ 69 “
1	“	at	75 years.

Of the entire number only 4, or 2.70 per cent., occurred before the sixteenth year, or during the developmental state of the mamma; 67, or 45.27 per cent., appeared between the sixteenth and fortieth years, or at a period when the breast and genitalia are functionally most active; and 77, or 52.02 per cent., after the fortieth year, or during the period of their functional decline. Spindle-celled tumors develop earlier in life than the giant-celled and round-celled, since the average age at which they were noticed was 36 years and 7 months, against 47 years and 3 months for the giant-celled, and 48 years for the round-celled. Unlike cystic and solid fibromata, cystic sarcomata appear at an earlier age than solid sarcomata, the average for the cystic being 38 years and 5 months, against 43 years for the solid variety. Hence it may be said that spindle-celled and cystic sarcomata are metaplasias of the functionally perfect mamma, and round-celled, giant-celled, and solid sarcomata are metaplasias of the declining gland. In point of fact, the fifteen sarcomata occurring before the age of twenty were spindle-celled in fourteen.

Thirty-three of the patients were single and fifty-seven were married when the tumor was first noticed, while the social condition is not noted in the remainder. Of the married women forty were multiparous, six had one child, and eight were barren; while the question of children is not stated in three. In two cases the disease showed itself during pregnancy, and in four soon after parturition. Of thirty-eight subjects in which the menstrual function is recorded, all were regular save one, who suffered from amenorrhœa. In seventeen instances, or one in every nine and one-third, injury was assigned as the cause of the tumor; in one it developed at the site of an abscess; in one it was preceded by psoriasis of the nipple; while in none was it inherited. These facts show that the etiology of sarcomata is most obscure, since their development is rarely traceable to injury or disease, and is not influenced by hereditary predisposition, while the social state and menstrual irregularities or arrest are surely unimportant agents in their production.

The increase of sarcomata is more rapid than that of the other connective tissue neoplasms, but it is liable to great diversity, being independent of the age of the subject, and influenced by their structure, by their degenerations, and by the absence or presence of cysts. Of the solid sarcomata I have met with six examples which varied from one to two inches in diameter in five, six, seven, and eight months; and, even at the end of two or three years, they may not be larger than an apricot[1] or a turkey's egg,[2] although they may, in their pure state, attain the volume of an adult head in four months,[3] or a circumference of twenty-five inches and a weight of four pounds and two-thirds in nine months.[4] When they are the seat of myxomatous degeneration or of softening cysts, they may weigh four pounds and twelve ounces,[5] or measure twenty-three inches in circumference and weigh six pounds, in four months.[6] Of the cystic, as of the solid, variety, I have seen examples in which it did not exceed a diameter of two inches in five and eight months; while it is rarely larger than a fist in one year. In exceptional instances, however, it may attain the volume of a double fist in three months,[7] or a weight of upward of ten pounds in the same number of months,[8] or a circumference of thirty-one inches and a weight of twelve pounds in one year.[9] As an evidence of its unequal rate of progress, we may state that it may require eighteen months,[10] five years,[11] eighteen years,[1] or forty years[2] to reach the volume of a fœtal head, or six years[3] or fifteen years[4] to attain the size of an adult head.

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[1] Reverdin: Bull. de la Soc. Anat., t. xlii. p. 708, and t. xliv. p. 285.

[2] Zambianchi: Ibid., t. xlvi. p. 314.

[3] Billroth: Chir. Klinik, Wien, 1869–70, p. 142.

[4] Bryant: Trans. Path. Soc. London, vol. xix. p. 387.

[5] Bennett: Cancerous and Cancroid Growths, pp. 12 and 256.

[6] Hewson: Gross's System of Surgery, 6th ed., vol. ii. p. 974.

[7] Post: Medical Record, 1872, p. 112.

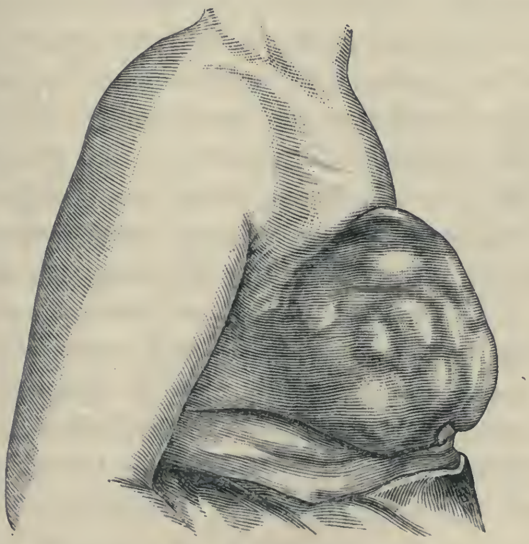
[8] Glück: Langenbeck's Archiv, Bd. viii. Jahresbericht, p. 599.

[9] Pitha: Ibid., p. 599.

[10] Hubert: Bull. de la Soc. Anat., t. xlviii. p. 690.

[11] Reverdin: Ibid., t. xliv. p. 281.

Like the cystic fibromata, sarcomata may remain stationary and of small dimensions for a long time, when, without obvious cause, they suddenly begin to increase, so that a nodule that has required fifteen years to attain the volume of a walnut reaches that of a double fist in three months;[5] or one which has remained the size of an egg for eighteen years, acquires the volume of an adult head in a few months;[6] or one that has been quiescent and of the size of a walnut for twenty-five years, suddenly begins to grow, and measures eighteen inches transversely by fourteen inches and a half vertically in three years;[7] or one that has been a year and a half in acquiring the volume of an egg grows to a circumference of twenty-six inches, and a weight of seven pounds in an additional six months.[8] In such cases rapid accumulation of fluid and solid contents in the dilated ducts may be looked for; or the increase in volume may be due to myxomatous changes and interstitial hemorrhage. Under similar circumstances their progress may be interrupted, of which I recently met with a notable example. On the 11th of November, 1886, I removed a proliferous cystic small spindle-celled tumor from a lady of sixty-five. At the age of twenty-five, she accidentally observed a tumor as large as a chestnut at the inner side of the right nipple. It remained of that size until the age of sixty-one, when it began to grow, and during the past year had doubled its volume, so that it was larger than a fœtal head. Its gross characters are shown in the illustration, and the breast



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[1] Pick: Trans. Path. Soc. London, vol. xx. p. 347.

[2] A personal case.

[3] Hubert: Ibid., t. xlvii. p. 389.

[4] Berbèze: Ibid., t. xli. p. 94.

[5] Marignac: Bull. de la Soc. Anat., t. lii. p. 428.

[6] Tillaux, quoted by Cordier: Thèse de Paris, 1880, No. 494, p. 16.

[7] Anderson: Trans. Path. Soc. London, vol. xxiii. p. 254.

[8] Marchand: Gaz. des Hôpitaux, 1869, No. 51, p. 196.

measured seven inches more in circumference than its fellow. Robin[1] has recorded a case in which a vegetating myxomatous spindle-celled tumor remained of the size of a hazelnut for six years, when it grew continuously for four years, and reached the volume of a fist, and then doubled its size in three years and a half, and during the last six months, or fourteen years from its first appearance, attained a weight of nine pounds. Tillaux[2] extirpated a cystic tumor which grew from the size of a filbert to a hen's egg in three years, at which size it remained stationary for four years, when in six months it acquired the volume of an adult head. Although these seven cases were examples of cystic tumors, their peculiar histories countenance the view held by Billroth, Labbé[3] and Coyne,[4] König,[5] Duplay,[6] and myself, that fibroma is frequently metamorphosed into sarcoma through multiplication of its cells and increased vascularization. The opponents of this view of a change of type may urge that a sarcoma may remain latent for many years, when, without obvious cause it begins to grow rapidly; but there is certainly no reason why a fibrous tumor should not serve as the mother tissue of a sarcoma as well as ordinary fibrous tissue. Be this as it may, a long period of quiescence and intermission of growth are not infrequent in sarcoma, and are of diagnostic value when compared with the progress of other neoplasms of the breast. As occurs in fibroma, continuous growth rather indicates freedom from cysts and vegetations, while sudden and rapid increase points to fluid accumulation and intracanalicular vegetations.

The growth of sarcomata might naturally be expected to be connected with menstruation, pregnancy, or lactation, or with conditions which render the mammary gland more vascular; but the influence of an increased flow of blood to the organ, which has been assumed by certain authors, is not confirmed by an analysis of the cases that I have collected. Thus, in only three examples was an increase in bulk witnessed at the menstrual period, while in two the tumor became smaller. In one the rapid growth began during pregnancy, and in two at the menopause.

From these considerations it follows that, while sarcomata constitute the most bulky of the mammary neoplasms,[7] their growth is so capricious that an average rate of increase cannot be assigned to them. On the whole, however, one is justified in concluding that the small-celled, the cystic, the myxomatous, and the telangiectatic increase more rapidly than the large-celled, the solid, and the pure tumors.

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[1] Journal de l'Anat. et de Phys., t. x. p. 195, and Bull. de la Soc. Anat., t. xlviii. p. 817.

[2] Cordier: Thèse de Paris, 1880, No. 494, p. 7.

[3] Chir. Klinik., Wien, 1871–76, p. 261.

[4] Traité des Tumeurs Bénignes du Sein., pp. 269, 283, and 363.

[5] Lehrbuch der Spec. Chirurgie, 4th ed., Bd. 11, p. 89.

[6] Traité Élément. de Path. Ext., par Follin et Duplay, t. v. p. 628.

[7] In his inaugural dissertation, Ueber Fibro-Adenom der Mamma, Göttingen, 1878, p. 13, Watson narrates a case from the practice of Kremer, in which the tumor weighed twenty-two pounds. Péan, in his Leçons de Clinique Chir., t. ii. p. 90, describes a myxomatous cystic spindle-celled sarcoma which weighed ten kilos, or more than twenty-six pounds, and a similar weight is recorded by Cordier, in his Thèse de Paris, No. 494, 1880, p. 40, from the practice of Tillaux.

The active growth of the sarcomata is liable to be attended with marked elevation of the temperature, as was noted in two of my own cases, in one of which Seguin's surface thermometer indicated 100° against 95° for the opposite breast. In two other examples of cystic sarcoma there was an increase in the heat, as roughly estimated by the hand. All of these tumors were highly vascular and composed of small cells, so that elevation of the temperature may be said to be characteristic of telangiectatic and rapidly proliferating growths. Further investigations in this direction may prove useful in determining the differential diagnosis of the connective tissue neoplasms, and should not be neglected.

During their further progress sarcomata continue, as a rule, mobile and free from superficial or deep attachments; the contiguous structures are not invaded by tumor elements; the skin remains natural in color and texture; the subcutaneous veins are not enlarged; the nipple is normal; and the associated lymphatic glands are not contaminated. To these general statements some exceptions must be noted.

α. While it is not uncommon for recurrent tumors to be more or less closely fixed to the pectoral muscle, and through it to the walls of the chest, it is a singular fact that the primary growth is, almost without exception, freely movable, and rarely attached even to the common integument. In a case of spindle-celled tumor recorded by Zambianchi, and it was an example of two growths in the same breast, the outlying tumor developed over the upper costal cartilages to which it adhered, and sent a prolongation into the thorax.[1] In 6 additional instances, the muscles of the chest were involved in 5, and the parammary fat in 1. The tumor was cystoid spindle-celled in 1, cystic spindle-celled in 2, round-celled in 1, osteoid round-celled in 1, and cystic giant-celled in 1. Just how often the skin is invaded is difficult of solution, since in some of the cases of ulceration it was, doubtless, converted into sarcoma tissue, but microscopic data of this fact are wanting. Be this as it may, the skin was adherent in 15 examples, of which 10 were cystic, and 5 solid tumors, the round-celled slightly predominating. If, in addition to the cases of invasion of the muscles, perichondrium, and connective tissue, these 15 cases be regarded as instances of invasion by tumor elements, sarcomata of the breast are to be regarded as locally infectious in 14.19 per cent. of all cases.

β. Although the skin may be stretched and attenuated, and ulcerated, as I showed in 18.59 per cent. of all examples, it was discolored in only 36, or in 23 per cent., and it is interesting to know that the changes in tint occurred twenty-seven times in the cystic and nine times in solid growths, three of which were the seat of degeneration-cysts, and that the round-celled tumors predominated. In twenty-one the tint was red, in four bluish, in ten violaceous, and in one livid.

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[1] Ante: Lagrange and Duret (Bull. de Soc. Anat., t. xlviii. p. 516) refer to a case in which, on post-mortem examination of a female who had for many years an enormous sarcoma of the breast, the tumor separated the fibres of the pectoral muscles, passed between two ribs into the cavity of the mediastinum, and penetrated between and compressed the lobes of the lung, without infecting any of these structures.

γ. The superficial veins were enlarged in 24 instances, or in 15.39 per cent., but only to a slight extent in 2. In 18 the tumor was cystic, and in 6 it was solid, but in the latter it was the seat of extravasation of blood in one, and of mucoid cysts in the second. The spindle-celled growths predominated.

δ. The nipple was retracted or umbilicated in only 5, and these were examples of cystic growths.

ε. Of the 156 cases the lymphatic glands were enlarged, and now and then tender, in 19. In 14 of these the enlargement was associated with the primary growth, but in only 1, a case of alveolar pigmented round-celled sarcoma, were tumor elements detected.[1] In the remaining 5, the glands were extirpated along with recurrent growths, and in 2 of these, one an example of round-celled sarcoma communicated to me by Dr. Markoe, of New York, and the second a case of alveolar giant-celled tumor,[2] were they infected. Hence the glandular enlargement was due to irritative hyperplasia in 16, in 10 of which ulceration of the tumor was present, while they were infected in only 3. This immunity of the glands from contamination is remarkable, and is a valuable sign in the differential diagnosis of malignant mammary growths.

A discharge from the nipple is not met with in the solid tumors, but occurs in one case out of every nine and a half of cystic sarcomata, the proportion being smaller than is met with in cystic fibromata, and is of great value as a symptom of enlargement of the ducts, although it is of itself unimportant in the differential diagnosis. In two instances from the practice of Bryant,[3] the discharge was the first symptom, and preceded the detection of the tumor by three months in one and by two years in the other case. In a third case, recorded by that surgeon,[4] the flow was bloody, and derived from highly vascular vegetations. In the case of Hubert,[5] the tumor augmented in size at each menstrual period, when there was an occasional discharge of a citron-colored liquid. In the examples of Billroth[6] and Winslow,[7] in which the neoplasm developed during pregnancy, there was also a spontaneous escape of a serous fluid; while in those of Lebert[8] and Verneuil,[9] a viscid transparent liquid was expelled by pressure.

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[1] Billroth: Die Krankheiten der Brustdrüsen, p. 56.

[2] Ibid., p. 58.

[3] Guy's Hospital Reports, ser. 3, vol. x. p. 115, and ser. 3, vol. xxviii. p. 468.

[4] Ibid., vol. x. p. 120

[5] Bull. de la Soc. Anat., t. xlviii. p. 389.

[6] Chir. Klinik, Wien, 1869 and 1870, p. 142.

[7] Maryland Med. Journ., vol. 12, p. 243.

[8] Physiologie, Pathologique, t. ii. p. 128

[9] Valude: Thèse de Paris, 1885, No. 91, p. 131.

The growth of sarcomata is attended with pain in 35.71 per cent. of all cases. In only 2.67 per cent., however, was attention first called to the tumor by suffering, and, in the remainder, it declared itself later, and varied in character and frequency in accordance with the variety of the sarcoma. Thus, in the solid form it was experienced in only 28 per cent. of the cases, and of these it was lancinating and continuous in 42.85 per cent., of an occasional darting character in 28.57 per cent., and lancinating and continuous only during the rapid increase of the tumor. In the cystic variety, on the other hand, it was felt in 41.93 per cent. of the cases, and in 69.23 per cent. of these it was, as a rule, severe and lancinating, and came on late in the disease, especially during rapid growth, when the tumor became tense through the increase of the contents of the cysts; while it was continuous and lancinating in 11.53 per cent., and slight in 19.23 per cent. In 14.28 per cent. of all cases it was only experienced when ulceration had set in, but ulceration and fungous protrusion provoked suffering in only 35.72 per cent. of all instances, and rarely increased it when it was previously felt. In one instance it was experienced only at the menstrual periods; while in three it was aggravated, and in one diminished, at that period. In only five cases was the growth absolutely tender, although in many examples it was annoying from its weight and bulk, so much so, indeed, in a case recorded by Pick, that the woman repeatedly tapped the cyst with a penknife to rid herself of these features.

During their further progress, as we have already seen, sarcomata may invade their limiting capsules and the neighboring tissues, and finally ulcerate. Without, however, of necessity pursuing this course, their capsules may remain intact, but none the less may they extend to the adjacent structures along the course of the bloodvessels, the adventitia of which is frequently the seat of small-celled proliferation, through which the tissues are converted into "latent zones of infection;" these zones are not appreciable by the naked eye, but serve not only as the points of departure of the recurrences that are so often witnessed after their removal, but also as foci of general infection with the production of deposits in the internal organs. Hence it is that the prognosis of sarcomata is eminently unfavorable, although there is still no little diversity of opinion among practical surgeons and pathologists on this point. Thus, Wilks and Moxon,[1] Cornil and Ranvier,[2] Labbé and Coyne,[3] and Erichsen[4] regard them, and particularly the cystic form, as being comparatively innocent, and only marked by a tendency to local reproduction. Labbé and Coyne and Erichsen deny the possibility of the general dissemination of spindle-celled tumors; and Erichsen, indeed, advances the doctrine that "the tendency to recurrence will, in most cases, gradually wear itself out, and after several operations have been required at intervals of months, or a year or two, the disease will cease to be reproduced, and a cure will be thus established;" although he adds, that "instances are not wanting in which the tendency to the local reproduction of the sarcoma has been so active that it outran all possibility of complete extirpation, and eventually destroyed the patient." Virchow[1] states that, while sarcoma may recur in loco, "it is a tumor of limited malignity, but fully capable of producing metastases;" and Lücke[2] indorses this view. Birkett,[3] Gross,[4] Ashhurst,[5] Klebs,[6] Billroth,[7] Annandale,[8] Winckel,[9] and Agnew,[10] on the other hand, fully recognize the malignant attributes of sarcomata as denoted by their capability of reproducing themselves, not only in the neighboring tissues, but also in remote parts; and other writers regard their progress as being "much more favorable" than that of mammary carcinoma.

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[1] Lectures on Path. Anatomy, p. 584, 1875.

[2] Manuel d'Histologie Pathologique, p. 1162.

[3] Op. cit., p. 431.

[4] The Science and Art of Surgery, 8th Amer. ed., vol. ii. p 710.

The greatest obscurity exists in regard to the cystic sarcomata, which include the tumors in which the dilated ducts are more or less closely filled with vegetations. This uncertainty is due to the fact that many English and German pathologists and surgeons class cystic adenomata, cystic fibromata, and cystic myxomata under the term cystic sarcoma. Marcus Beck,[11] the latest writer on the subject, indeed, denies the presence of duct cysts in sarcoma.

In 1880 I certainly established the fact that all the varieties of sarcoma of the breast are malignant; and a careful study of 92 of the 156 cases upon which this paper is based, and in which the final reports extend beyond the mere statement of the recovery or death of the patient, confirms this view.

Of the 92 cases only 1 ran a natural course, it being an example of round-celled tumor of both breasts, that proved fatal, with presumed secondary deposits, in seven months from the first appearance of the disease. The remaining 91 were subjected to the knife. Of these, 32 were well for periods which varied between one month and ten years and nine months; 42 were marked by local recurrence; in 8, not only was there regional reproduction, but metastases were found post-mortem; 3 recurred, with unmistakable evidences of general dissemination; 4 were characterized by metastases, and 2 by presumed metastases, without recurrence. In other words, 64.83 per cent. of these cases were endowed with malignant features. Let us examine these general statements more in detail.

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[1] Op. cit., p. 362.

[2] Pitha and Billroth's Hdbch. der Allg. und Spec. Chir., Bd. ii., Abth. i., p. 194.

[3] A System of Surgery, edited by Holmes and Hulke, 3d ed., vol. iii. p. 451.

[4] System of Surgery, 6th ed., vol. ii. p. 973.

[5] Phila. Med. Times, vol. ix. p. 384, 1879.

[6] Op. cit., p. 1118.

[7] Die Krankheiten der Brustdrüsen, p. 60.

[8] Internat. Encyclop. of Surgery, vol. v. p. 842.

[9] Lehrbuch der Frauenkrankheiten, p. 754.

[10] Princ. and Pract. Surgery, vol. iii. p. 702.

[11] Dictionary of Practical Surgery, edited by Heath, p. 183.

32 patients were alive and well for an average period of 49 months and 10 days after operation, the disease having existed, on an average, for 69 months and 11 days before surgical interference, so that the mean life of these subjects was nearly ten years. The period of freedom from recurrence was

From 1 to 12 months,	in	4 cases.[1]
“ 1 “ 2 years,	“	4 “
“ 2 “ 3 “	“	7 “
“ 3½ “ 4 “	“	5 “
“ 4 “ 5 “	“	5 “
For 7 years and 3 months	“	1 case.
“ 8 “	“	1 “
“ 9 “ “ 11 “	“	1 “
“ 10 “	“	1 “
“ 10 “ “ 4 “	“	1 “
“ 10 “ “ 5 “	“	1 “
“ 10 “ “ 9 “	“	1 “

As has been seen, there was local reproduction in 53 cases. In 45, in which the date is noted, the periods of recurrence were as follows:

2	cases in	3 weeks.	3	cases in	12 months.
2	“ “	1 month.	1	case “	15 “
7	“ “	2 months.	1	“ “	17 “
3	“ “	3 “	2	cases “	18 “
2	“ “	3½ “	1	case “	20 “
2	“ “	4 “	1	“ “	21 “
5	“ “	5 “	3	cases “	24 “
3	“ “	6 “	1	case “	29 “
1	case “	7 “	1	“ “	32 “
1	“ “	8 “	1	“ “	36 “
1	“ “	9 “	1	“ “	48 “

The table shows that more than one-half, or 57.7 per cent., of the reproductions took place in 6 months, while after 12 months there were only 13, or 28.8 per cent., and of these there were only 4, or 8.8 per cent., after 2 years. These statements lead to the belief that the chances for the patient are relatively good after the lapse of 2 years, and that the prognosis is all the more favorable as the period of freedom from signs of local contamination prolongs itself. As the latest date of reproduction was 4 years, we may assume that the 12 cases of the first table which remained well after the lapse of that time were permanently cured. The average date of recurrence was 10½ months, and the total life of these patients from the first observation of the disease to the final report after the last operation was 7 years and 9 months. The number of recurrences, or operations for recurrence, was 1 in 23 cases, 2 in 13 cases, 3 in 7 cases, 4 in 1 case, 5 in 4 cases, 6 in 2 cases, 7 in 1 case, 12 in 1 case, and 22 in 1 case.

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[1] The shortest periods were 1 month, 4, 6, and 10 months.

While the average was 10½ months, the histological constitution of the growth appears to have exerted a marked influence upon the date of recurrence. Thus, the average date of local reproduction was 4 months and 20 days for the round-celled, 11 months and 27 days for the spindle-celled, and 12 months and 10 days for the giant-celled. The cystic tumors recurred in 8 months and 5 days, and the simple in 13 months and 9 days, and this contrast becomes the more striking when we state that the average date of recurrence for cystic round-celled growths was 3 months and 4 days as against 6 months and 8 days for the simple round-celled, and 9 months for cystic spindle-celled as against 16 months for the simple spindle-celled.

Of the 91 cases metastatic growths, as demonstrated post-mortem, or by unmistakable evidences during life, had formed in 17, or 18.68 per cent. There can be no doubt that this estimate is too low, since of 20 examinations of persons dead from the effects of the primary operation, or dead after secondary operations, metastatic growths were found in 12, or 60 per cent. The total duration of life from the first appearance of the primary tumor to the death of the 17 patients was 57 months, 9 months having been the shortest, and 25 years and 7 months the longest, period. The relative frequency of the seats of the secondary deposits is shown by the following statement:

Lungs,	in 10 cases.	Pleura,	in 1 case.
Liver,	" 4 "	Heart,	" 1 "
Brain,	" 3 "	Kidney,	" 1 "
Dura mater,	" 1 case.	Muscles,	" 1 "
Retroperitoneal glands	" 1 "	Bones,	" 1 "
Mediastinum,	" 1 "		

The prognosis is materially influenced by the age of the patient and by the size and rate of increase of the tumor. Thus before the age of thirty-five, when the mammary gland is functionally most active, a small, slowly growing sarcoma does not return, while a rapidly increasing tumor, especially the cystic variety, is very liable to recur. Among the latter class of cases, 60.71 per cent. were characterized by recurrence, and 10.71 per cent. by metastatic tumors. Of these, the solid sarcomata recurred in 53.84 per cent., and gave rise to secondary growths in 7.69 per cent., while the cystic recurred in 66.66 per cent., and were marked by metastases in 13.33 per cent. It does not appear, however, as many writers assert, that the more tender the age the more rapid is the growth of, and the more malignant is, the neoplasm. Thus, of 15 cases, the ages of which varied from 9 to 19 years, or 16$\frac{1}{5}$ years on an average, the tumor had been in existence on an average for 7½ years before its removal, and 28.57 per cent. remained well, while 71.43 per cent. recurred, and metastases were not observed in a single instance. After the thirty-fifth year, on the other hand, and the danger increases with advancing age, the greater is the liability to metastases, as in this class of cases 19.35 per cent. were generalized, and 43.54 per cent. recurred. Of these, the solid tumors recurred in 47.05 per cent., and gave rise to secondary growths in 23.54 per cent., while the cystic recurred in 44 per cent., and were marked by metastases in 16 per cent. of all cases. In other words, a sarcoma occurring in a functionally active breast evinces a marked disposition to recur after operation, with less disposition to metastases, while a sarcoma of the declining breast recurs less frequently, but is generalized in a greater number of instances.

The prognosis is also influenced by the histological constitution and the stage of evolution of the tumor. Of the spindle-celled 65.10 per cent. recur, and 20.40 per cent. give rise to metastatic growths; of the round-celled 60 per cent. recur, and 25 per cent. are generalized; of the giant-celled 57.14 per cent. recur, and in none are there metastases; of the solid 64.58 per cent. recur, and 25 per cent. are disseminated; while of the cystic 51.16 per cent. recur, and 11.62 per cent. are generalized. Hence, while the round-celled are the most malignant, the metastasis of the spindle-celled is by no means to be denied, nor can we say, with certain writers, that the cystic variety is an innocent tumor, or one of limited malignity, since it recurs in more than one-half of all cases, and generalizes itself in about one case out of every nine. These investigations demonstrate that the usual statements, which are so opposed to the actual facts, as to the malignity of sarcomata, are due either to their not having been based upon a careful analysis of a sufficient number of recorded cases, confirmed by minute examination, or to the confounding of cystic sarcomata with other cystic growths, which never infect the economy.

While I have been unable to collate cases in which the disease ran a natural course, through which we are deprived of data bearing upon the duration of life in this class of patients, and comparing them with the average duration of life of those subjected to the knife, there can be no doubt that operations do result in permanent recoveries, and prolong life, even if a final cure is not attained. From an inspection of the two tables on a previous page, it appears that recurrence may be delayed for four years, and that 12 subjects were alive and well after four years, so that if we take four years as the criterion of safety, the 91 operations show 13.18 per cent. of cures.

Although the recurrent regional disease is more intense than the primary, and other reproductions generally follow in quick succession, the removal of tumors as fast as they appear certainly alleviates suffering, prolongs life, averts visceral contamination, and occasionally brings about a cure. Thus, Bryant[1] removed the entire breast for a round-celled sarcoma on January 9, 1883, and up to February 10, 1886, performed twelve operations for multiple recurrent growths, the opposite breast being the seat of an atrophic scirrhus of sixteen years' standing. Billroth[2] enucleated a cystic sarcoma, and removed four recurrent growths in four years, the breast being extirpated at the last operation, and the woman was free from disease three years subsequently. Erichsen[3] extirpated the entire breast for a cystic growth of twenty-seven years' standing in 1859, and removed recurrent growths in 1861, 1863, 1864, 1865, and 1866, death ensuing from paralysis "some years after the last operation." In Heath's[4] case of removal of the gland for a spindle-celled tumor, six operations for recurrences were done in thirteen years, and the patient was alive with a seventh recurrence. In that of Haward,[5] a spindle-celled tumor was removed in 1860, and recurrent growths were excised in 1863, 1869, and 1873. The patient died, without metastases, from the effects of the last operation, but life was prolonged, as in the preceding instance, for thirteen years. Riedel[6] removed six recurrences in twenty years following an operation for giant-celled sarcoma, and on death there were no metastases. Gay,[7] in May, 1865, enucleated from the same breast two cystic spindle-celled sarcomata of six years' standing. Recurrent growths were removed in July, 1867, with the entire gland, in May, 1869, and May, 1874, in June, 1878, in May, 1880, and in June, 1881, so that life was extended for fourteen years, and the woman was still living at the date of the last report. The case of S. D. Gross,[8] however, is, so far as I know, the most remarkable on record. In March, 1857, a single woman, aged forty-four, discovered a small tumor in the left breast, which, on enucleation the following October, proved to be a small spindle-celled sarcoma. During the next sixteen months two more partial operations were performed, and a fourth tumor, along with the entire breast, was extirpated in May, 1859. In three months and a half the knife was again required, and soon afterward other tumors were removed. In 1860 she underwent eleven operations, and six in 1861, the last of which was performed in September of that year, so that she was subjected to twenty-two operations for fifty-one recurrent tumors in four years. They varied in size from an almond to a hen's egg; appeared at or near the cicatrices in a few weeks, and rapidly assumed a fungating aspect. Large portions of the pectoral, and also of the external and internal intercostal muscles were cut away, so that during a deep inspiration there was a slight protrusion of the pleura. Ten years and nine months after the last operation she was in perfect health. In these eight cases there was no lymphatic involvement, and the general health was unimpaired.

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[1] Private communication, March 6, 1886.

[2] Die Krankheiten der Brustdrüsen, p. 68.

[3] The Science and Art of Surgery, 8th Amer. ed , vol. ii. p. 711.

[4] British Medical Journal, 1878, vol. i. p. 194.

[5] Trans. Clin. Soc. London, vol. vii. p. 106.

[6] Centralblatt für Chirurgie, 1881, Bd. 8, p. 636.

[7] Trans. Path. Soc. London, vol. xvi. p. 240; vol. xx. p. 359; vol. xxv. p. 233; vol. xxxi. p. 272; and vol. xxxiii., Suppl. p. 24.

[8] A System of Surgery, 6th ed., vol. ii. p. 974.

A study of the preceding facts shows that, like carcinoma, sarcoma is a malignant growth. It differs, however, from the former in many important features, which are shown in the following statement:

	Sarcoma.	Carcinoma
Invasion of the skin by tumor elements .	9.67 per cent.	68.92 per cent.
Invasion of the chest walls	3.87 "	21.58 "
Invasion of the parammary connective tissue	0.64 "	8.39 "
Primary invasion of the axillary glands .	0.64 "	67.35 "
Local reproduction after removal . .	58.24 "	80.97 "
Metastases found post-mortem . . .	60.00 "	50.00 "
Average duration of life	81 months.	39 months.
Permanent cures	13.18 per cent.	10.39 per cent.

From this table it appears that sarcoma is less infectious locally, but more infectious as regards the general system, than carcinoma. Its more relatively benign character is shown not only by the larger proportion of cures, but also by the fact that the average duration of life, from the first observation of the disease to the date of the last removal after operation, is forty-two months longer; and this contrast becomes the more striking when it is stated that the majority of the sarcomatous patients were still living, and the majority of the carcinomatous subjects were dead. Not only is this statement true for sarcomata in general, but it holds good for the three varieties, since the average life for round-celled sarcoma is fifty-four months, ninety months for the spindle-celled, and one hundred and eight months for the giant-celled.

The diagnosis of small, slowly increasing fibrous sarcomata is by no means easy, as they are very liable to be confounded with fibromata, particularly when they arise at the circumference of the mamma. A tumor, however, of soft, apparently fluctuating consistence, with elevated temperature, conveying the impression of an abscess, and occurring in young women, which attains a large volume in a few months, can scarcely be anything else than a medullary sarcoma. On the whole, the diagnosis is based upon their indolent origin, mobility, elastic, or unequal consistence, lobulated outline, rapid increase, freedom from lymphatic involvement, their tendency to ulcerate, the not infrequent discoloration of the skin, and enlargement of the subcutaneous veins, and, possibly, elevation of temperature; upon the suffering which they awaken late in the disease; and upon their greatest frequency after the fortieth year.

The only tumors met with before the age of sixteen are fibromata and sarcomata, the former being twice as common as the latter. The fibromata are always solid, and grow slowly, while the sarcomata are cystic in three-fourths of all instances, and medullary in the remaining fourth, and, as a rule, grow rapidly. Hence cystic and medullary tumors at this period of life are sarcomata and nothing else.

Between the spindle-celled, round-celled, and giant-celled there are some marked similarities which render their differentiation difficult. The spindle-celled, however, are characterized by their development at a comparatively early age; by the attendant suffering; by the enlargement of the subcutaneous veins; by their slow reproduction after removal; and by their long life. The round-celled, on the other hand, appear, as a rule, at a comparatively late age, and are painless; but the skin is liable to be discolored and ulcerated, and recurrence is rapid, and the duration of life is relatively short. The giant-celled likewise appear late in life, but are painful; discoloration of the skin and ulceration are also common; but there is no enlargement of the veins, while irritative enlargement of the axillary glands is frequent. Local reproduction is delayed longer than in the other varieties, and the duration of life is remarkable.

These points are set forth in the following table, in which the affinities and contrasts of the three principal varieties may be seen at a glance:

	Spindle-celled.	Round-celled.	Giant-celled.
Average age of appearance . .	36 years.	48 years.	47 years.
Appear before 16th year . .	12.08 per ct.	0.83 per ct.	0 per ct.
Pain	60.00 “	10.81 “	43 “
Skin discolored	20.88 “	32.35 “	25 “
Ulceration	17.58 “	23.58 “	25 “
Veins enlarged	17.58 “	11.76 “	0 “
Glands swollen	6.59 “	8.82 “	37.5 “
Glands infected	0. “	2.94 “	0. “
Adjacent tissues invaded . .	13.18 “	17.64 “	25 “
Local reproduction	65.10 “	60. “	57.14 “
“ “ average date of	12 months.	4⅔ months.	12⅓ mos.
Metastatic deposits	20.40 per ct.	25 per ct.	0 per ct.
Average life with operation . .	90 months.	54 months.	108 mos.

Between the solid and cystic varieties there are certain distinctions, which are useful in establishing a differential diagnosis. The former develop at about the forty-third year; the skin is discolored in 11.53 per cent; ulceration occurs in 7.69 per cent.; the veins are dilated in 7.69 per cent.; there is no discharge from the nipple, nor is it retracted; pain is met with in 28 per cent.; the surrounding tissues are invaded by tumor elements in 11.54 per cent.; the lymphatic glands are enlarged in 11.54 per cent., and infected in 1.28 per cent.; recurrence ensues in 64.58 per cent., and metastatic growths are met with in 25 per cent. of all instances. Cystic sarcoma starts, as a rule, at the thirty-eighth year, and is not, as is asserted by many writers, most common between twenty and thirty-five years, as just as many cases occur after as before the latter age; it grows more rapidly than the solid variety, and its increase is often sudden after having remained stationary or advanced slowly for some time. Now and then, after evacuation of the fluid of the superficial cysts, their solid contents can be detected by manipulation; their consistence is, as a rule, unequal, and they are more largely lobulated than the former variety. The skin is discolored in 34.61 per cent.; the tumor ulcerates in 18.76 per cent; the veins are enlarged in 23.07 per cent.; the nipple is retracted in 6.41 per cent., and discharges fluid in 10.25 per cent; pain is experienced in 41.93 per cent.; the adjacent tissues are infected in 16.66 per cent.; the lymphatic glands are swollen in 5.12 per cent., but they are never invaded by tumor elements; while it recurs in 51.16 per cent., and becomes generalized in 11.62 per cent. of all cases.

There are no signs by which cystic sarcomata can be absolutely differentiated from cystic fibromata, with which they are so frequently confounded. The latter develop earlier in life, and a discharge from the nipple is more common than in the former; but ulceration and enlargement of the veins are only one-half as frequent, and they are not attended with glandular enlargement or malignant features. It should, however, be stated that the largest proliferous cystic tumors met with in old, married multiparæ are generally sarcomata

As no attempt has hitherto been made to describe the life history of the giant-celled variety, and some of the modified forms of mammary sarcoma, the following facts will be found to be not devoid of interest.

In 8 cases of giant-celled tumors that I have collated, the average date of their first observation was 47¼ years, or at the ages, respectively, of 42, 45, 45, 46, 46, 49, 50, and 55. Of the 6 cases in which the social condition is noted, 3 were married, of which 2 were parous, and 3 were single. The tumors were solid in 6, of which one was alveolar, and cystic in 2. The skin was violaceous in tint and adherent in one case of cystic tumor, and red and stretched in one of solid tumor. In one of the cystic tumors there was firm attachment to the great pectoral muscle. Ulceration was met with in 3, of which 2 were solid and 1 was cystic. The axillary glands were enlarged but not infected in 3 cases, 2 of which were cystic and 1 was solid, and enlarged lymphatic glands were detected in 3 cases of recurrence of solid tumors, in 1 of which, an alveolar growth, they were invaded by tumor elements.

All of the cases were subjected to the knife. In 1 the history ceases with the operation.[1] In 3 there was no recurrence, and the patients were alive subsequently for ten years and five months,[2] three months,[3] and ten years.[1] In 4 the tumor recurred. In Billroth's[2] case, a reproduction, with infected glands, was removed in two months, and another similar operation was performed in a few months. The patient died of erysipelas, but metastases were not found post-mortem. In the case of Riedel,[3] six recurrent growths were removed in twenty years, and on death it was found that the patient was free from metastases. In the case of Estlander,[4] a recurrent growth, along with the glands of the axilla, was removed in two years and five months, and the patient was well five years and nine months subsequently; while in the case of Stanley,[5] the patient died with a recurrent tumor in two years after the extirpation of the breast. The average total duration of life of these patients from the first observation of the disease to the final report was nine years.

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[1] Estlander: Rev. Mens. de Méd. et de Chir., 4, 1880, p. 795.

[2] Ibid., p. 796.

[3] Lancereaux: Bull. de la Soc. Anat., t. xxxv. p. 292.

It will thus be seen that giant-celled, or myeloid, sarcoma sets up irritative enlargement of the lymphatic glands in 37.5 per cent. of all cases; that the skin is discolored, the tumor ulcerated, and the surrounding tissues are infected in 25 per cent.; that the subcutaneous veins and nipple are normal; and that, while it recurs in 57.14 per cent., it never gives rise to metastatic growths.

Osteoid sarcoma, or the variety which contains true osseous tissue, has been met with at the ages of 27, 46, 49, and 51 years, the average being 43 years. It occurs usually in married multiparæ; as a rule grows slowly; is hard, except when it has undergone cystoid degeneration; acquires large dimensions in one-half of the cases, and is painful during its rapid growth. It ulcerates in one-fourth of all instances; invades the adjacent tissues in one-half; does not infect the lymphatic glands, nor is it marked by dilatation of the superficial veins.

The case recorded by Durham[6] is devoid of further history. Of the three reported by Stilling,[7] in which an operation was practised, one died in twenty-three months, without recurrence, but with evidences of metastatic growths in the lungs and pleuræ; one died of pneumonia on the third day, with secondary tumors of the lungs, and sarcomatous thrombosis of the veins of the pectoral muscle, the disease having existed for eighteen months; and the third was characterized by two local reproductions, and a metastatic growth of the left ventricle of the heart, about sixteen weeks after the primary operation, the total life having been ten years and four months. The average life of these cases from the first observation of the disease until its termination was fifty-seven months, and the average life after operation was thirteen months and a half. Hence, metastases occurred, or were presumed to have occurred, in all the cases, and of those who survived the knife local reproduction was witnessed in one-third, and a recurrent growth would certainly have been formed if the patient with sarcomatous pectoral veins had survived. From these considerations, osteoid sarcoma must be regarded as the most malignant of the mammary sarcomata.

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[1] Paget: Trans. Clin. Soc. London, vol. vii. p. 108.

[2] Die Krankheiten der Brustdrüsen, p. 58.

[3] Centralblatt für Chirurgie, 1881, No. 40, p. 636.

[4] Ut supra.

[5] Paget: Lect. on Surg. Path., 3d ed., p. 555.

[6] Trans. Path. Soc. London, vol. xxxv. p. 378.

[7] Deutsche Zeitschrift für Chirurgie, Bd. xv. pp. 247–253.

The life history of pigmented alveolar round-celled sarcoma can only be based upon two cases. In that of Billroth,[1] a hard tumor, of three years' duration, as big as a child's head, and adherent to the skin, was removed, along with infected glands, from a multipara sixty-five years old. The patient died of exhaustion, without recurrence, in eight months, but there was no post-mortem examination. In the case of Butlin,[2] a tumor of seven years' standing was removed, in 1880, from the otherwise normal breast of a woman of fifty-eight. Recurrent growths were extirpated in 1882, 1884, and 1886, but the history ceases with the last operation. In addition to these cases, Wacker[3] describes a case of multiple melanotic alveolar round-celled sarcoma of both breasts, with infection of the glands of the left axilla, and metastatic tumors of the spleen, mesenteric glands, and brain. The disease was thought to be secondary to melanotic sarcoma of the skin of the mammæ. Winckel depicts a proliferous myxomatous melanotic sarcoma, but the case is devoid of history.[4]

The treatment may be summed up in a few words. The entire breast, along with any skin that may be invaded, must be extirpated, especial care being paid to the complete removal of every particle of parammary fat and the fascia of the pectoral muscle, in which tissues experience shows that recurrence takes place. In the event of repullulation the growths should be freely excised as fast as they appear, as such a practice not only prolongs life, but may bring about a final cure.

ON THE REMEDIAL VALUE OF BLOODLETTING.

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It has often seemed to me a matter of regret that a remedy of such unquestionable power as bloodletting should, from former abuse, be reckoned by many as among the things of the past, and that it should have run the risk of being denied all virtue, because of some inherent faults, which, however, are quite capable of compensation. Its very power, and the exact results which in fitting cases attend its employment, doubtless led to its indiscriminate use, and, inasmuch as it is spoliative in its nature—a power fraught, it may be, with the greatest evil—it is not difficult to see how readily it might be abused. The dangers attaching to this abuse once fully recognized, the extreme oscillation was readily foretold, for in medicine, as in the sciences, which are—maybe—more exact, the pendulum of opinion swings freely and its resting points may be very widely distant.

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[1] Op. cit., p. 56, fig. 57.

[2] Lancet, January 8, 1887, p. 72.

[3] Inaug. Disser., Rostock, 1884, p. 15.

[4] Lehrbuch der Frauenkrankheiten, p. 756.

Bloodletting is not the only form of treatment to which time and increase in knowledge have carried wise modifications. Thirty years ago there developed what many now regard as a craze for alcohol-giving, and when we note the position it held then, and call to remembrance that which it holds now, we may almost cherish a hope that a power as valuable, and not more difficult to handle, may again take a recognized position as a valuable remedy. With that greater skill which is undoubtedly ours, with that more intimate acquaintance with physiological and pathological processes, we are better able to judge the exact capability of such a remedy, and when we recognize in it the power to modify the distribution of the blood, and to diminish pressure within the vascular system, then we are moving on such lines as are well fitted to guide us in its employment. That it can do more than these things is probable. That it does act as a derivative, that it is a powerful though dangerous sedative, and that its employment facilitates the action of other remedies is all possible, and, although I believe that few would incline to employ it for such ends solely, its possession of such potentialities may render it of wider service than we anticipate when we use it.

Maybe the strongest objection to its employment lies in the dread that by the abstraction of blood we tend directly to weaken our patient; but this fear is, I am sure, exaggerated. Several observers, among others Sir James Paget, believe that bloodletting in limited quantity is attended with little risk of immediate or remote injury, and a physician of such eminence and ability as William Pulteney Alison states "that the idea of subsequent injury to the constitution from the use of bloodletting in inflammatory diseases may, in general, be regarded as quite visionary." Every obstetrician must have noted the absolutely unimpaired recovery of lying-in women in whom a moderate post-partum hemorrhage has occurred, and to the surgeon it is a matter of every day experience that in the large majority of surgical operations not complicated by previous shock, and unattended by excessive hemorrhage, a certain loss of blood in no wise hinders a satisfactory convalescence. In making such references I know that I lay myself open to the very evident contention, that such patients are, at the time the loss is sustained, in the full tide of health, but this is hardly so, for the blood of the pregnant woman, although greater in bulk, presents those very characters which excessive hemorrhage develops—it is deficient in hæmatin, and it contains an excess of fibrin; while most surgical patients demanding for their relief severe operative measures cannot, as a rule, be held to have the fullest health. Moreover, it happens that in many cases of debilitating disease, hemorrhage, it may be as the effort of Nature, does occur, and its occurrence hinders neither the favorable progress of the malady, nor the convalescence from it. One such instance occurs to me now. A young gentleman, a patient of Dr. Walker, of Dalston, who has for many years been the subject of mitral disease with well-marked aortic regurgitation, and who for the past two years has had chronic Bright's disease, was at the end of last autumn seized with acute pleuro-pneumonia. A more unpromising case it would be difficult to find, for he had suddenly superadded to his burden of chronic and incurable disease, an acute inflammatory ailment, attended with high temperature, much dyspnœa, and very considerable physical suffering. Owing, in part, to the existence of renal disease, and doubtless, in part, to the presence of aortic insufficiency, he had on the night of my first visit a considerable epistaxis. That it had done him no harm Dr. Walker was confident, and my own feeling was that it had probably done him good. A recurrence happened some days later, and, although upon that occasion, owing to the absence of his doctor, he lost a good pint of blood, which, undoubtedly, *temporarily* debilitated him, he struggled through his pneumonia, and, what was even more satisfactory, he recovered after a single tapping from the empyema of which his pleural effusion was constituted. Had excessive dyspnœa demanded it, how few would have dared to bleed this man to twelve ounces, and yet events demonstrated that even such a loss was not incompatible with a satisfactory recovery.

It has been written by a great clinician that "men bear no mark that denotes their great or their small susceptibility to mercury," and this in a measure seems true of bloodletting also, for in the case of chronic disease I have related a very considerable hemorrhage made little apparent difference, whereas Dr. John Duncan tells me that an athletic student who, in perfect health, was bled for purposes of transfusion, was long in recovering from its effects. That idiosyncrasy should exist with reference to bloodletting, experience in the use of many other remedies would lead us to expect.

In considering the advisability of the employment of bloodletting, the primary questions which arise are these: Is the condition of the patient so urgent as to demand its aid, and is there a fair probability of the loss he will thus sustain being satisfactorily replaced? Wise and necessary as is this association of interests, and important as is its general maintenance, it is easy to understand how the importunity of the one may, at times, justly overrule the prudence of the other, for when life is in imminent jeopardy we must act for the present, cherishing the hope that the good to be attained may quite outdo the evil attendant upon the letting of blood. And this position is made still stronger when we call to remembrance the fact that in the very large majority of cases the loss of blood need not be great, for the effect we desire is an *immediate* one, one if at all attainable, produced very quickly, and, therefore, bloodletting by possessing this quality has that within itself which is adverse to the withdrawal of an inordinate amount. Thus is it that the aphorism of Sir Thomas Watson is readily compassed, " bleed so as to secure the advantages of the remedy and to avoid its disadvantages," and with a view to a demonstration of the value it certainly possesses, I will, in dealing with this question, relate some of the scattered lessons of my own limited experience.

When bloodletting was in the plenitude of its power there was no morbid condition in which it was employed more unhesitatingly than in apoplexy. The reasons for this are not difficult to seek, for, homœopathic as such treatment may be reckoned, there can be no reasonable doubt that in many cases of severe visceral hemorrhage, general bloodletting is alone able to control it. The temptation to make this knowledge the foundation for action was doubtless increased by the condition of the pulse generally associated with cerebral hemorrhage; for the feeling it conveys through its very fulness is that of its hurrying on in such a volume as is certain to increase extravasation and nerve destruction. Thus, I fancy, it was that bloodletting became the " summum remedium " in all cases of apoplexy, and, although we now know that in the very large majority of instances it is not only a powerless, but a dangerous remedy, there is one form of attack in which most physicians agree it may still be employed with possible benefit—that form is the ingravescent. Unhappily, the cases are rare in which opportunity offers for its use, for its earlier march, at times slow enough, it may be, to anticipate, is too frequently hastened by the attacks of vomiting which characterize it.

In the last two cases that have come under my observation this history was most notable, for with the access of vomiting there came such acuteness in the development of coma, that it quite outran any possible good derivable from bloodletting.

That in fitting cases—cases seen early in their progress—it may prove useful I shall endeavor on lines which are fairly parallel to show.

Experience gained by the surgeon is often of equal value to the physician, for, although the conditions which give rise to certain results differ, the results themselves are so akin that the danger pertaining to them has a common significance. Therefore it is that I quote the following case to show that in bloodletting we have a remedy of value in "ingravescent apoplexy," albeit that apoplexy be external to, instead of within, the cerebral cortex.

M. B. was thrown with great force from the conveyance in which he was driving, and pitched upon his head. He had well-marked concussion, followed by decided reaction, with a full, but not too rapid pulse. Some hours after he was first seen he was attacked with severe headache, complained of a rushing noise in his ears, had some embarrassment in his breathing, was a little confused, had widely dilated pupils acting slowly to light, and his pulse had fallen from over 80 to 52 in the minute. He was at once bled to the extent of a pint, which relieved his headache, and his breathing, and under which his pulse rose to its old rate of 80 in the minute.

A few days after, having, contrary to all instruction, risen from his bed and made some exertion, the old symptoms reappeared, headache, dilated inactive pupils, and slow, laboring pulse. Venesection again, and with this great relief, and an ultimate satisfactory recovery.

It may fairly be argued that in this case I have no certain proof to offer that extravasation had occurred, and I am glad that such proof is wanting, but I have notes of another case in which, following a severe blow on the head, there were, on three separate occasions, attacks exactly similar to those observed in M. B., the last of which, unhappily, proved fatal, and in that instance a post-mortem examination demonstrated the presence of a large clot, part of which had been recently effused, but of which other portions had, undoubtedly, been in existence for some little time. I record it as a matter of regret, that this case was not treated by venesection. It seems then but a fair deduction that a remedy which can arrest hemorrhage occurring outside the brain, should have equal power to control leakage taking place in its substance.

The power for good possessed by bloodletting in morbid states of the cerebral circulation is not, however, confined to the arresting of hemorrhage. There are certain pathological conditions attended by convulsive phenomena over which it exercises a happy control. The rationale of this is readily found through a mechanical explanation, for the tightly packed, and the unyielding character of the cerebral case, renders any disturbance in its vascular system fraught with very decided danger. If the amount of blood circulating in it be of necessity an ever definite quantity—and this, I believe, has been fairly demonstrated—then it follows that disturbance, say of a spasmodic character, in the arterial system must be associated with a plethora on the venous side. By their researches, Kussmaul and Tenner proved that sudden cerebral anæmia may induce convulsion, and there is a strong probability that the "status epilepticus," when fully developed, depends upon a pronounced anæmia in certain cerebral areas. This was the contention of Sir J. C. Brown, and the basis upon which he founded his treatment of it by the use of nitrite of amyl. Before, however, this valuable remedy had been used in this way, it had happened to me to find how completely this dangerous condition could be relieved by free venesection.

One case I well remember, where the fits recurred with such rapidity and regularity, and where the intervals were marked by so profound a state of coma, that the man's condition seemed well nigh hopeless. A big bleeding, for he was a strong, healthy man, at once arrested his fits and, I believe, saved his life. That it acted by relieving a stasis in the cerebral venous system, and thus permitted a readier transmission of blood through the smaller arteries and capillaries, is probable.

Trousseau draws attention, in one of his masterly lectures, to the fact that in certain cases of convulsive epilepsy we may have a state of tonic convulsions lasting for a long time, "two or three minutes, instead of three times the number of seconds, and death from asphyxia as a consequence." I once witnessed in a little girl, the subject, not of true epilepsy, but of most severe convulsions depending upon a functional cause, this very state established, and the happy issue that resulted from the abstraction by me of a few ounces of blood from the external jugular, was one of the early experiences of my professional life.

If the theory of Dr. Hughlings Jackson (*Brain*, April, 1886) be correct, that infantile convulsions depend largely for their development upon a venous condition of the blood circulating in the respiratory centre, then it is not difficult to understand how oft-repeated and long-continued spasm, interfering as it does with the respiratory act, should perpetuate the tumult, and how direct relief to the venous system may speedily arrest the convulsive disturbance.

Before proceeding to allude to those conditions in which the benefit attending bloodletting is conspicuous and undoubted, I would make mention of the advantage which attends its employment in certain cases of simple croup. I am not likely now ever to forget—for the early writings on the folds of memory are the most indelible—the relief which I, when a little lad, suffering from croup, obtained by venesection. Emetics, hot fomentations, and the warm bath, had all been employed, but with no benefit, the dreadful feeling of suffocation was still unrelieved, while following immediately the withdrawal of several ounces of blood from the arm I was easy and comfortable.

It would be a marvel, then, that if thus taught, it seemed the lesson of a *life* in its fullest sense, I should have denied the same relief to others, and thus it is that, in late childhood and early youth, when other means have failed, and when in vigorous adolescents, cynanche laryngea is marked by the symptoms noted by Cullen, "respiratio difficilis, inspiratio strephens, vox rauca, tussis clangosa," then my trust, and my expectation, lie in a moderate phlebotomy.

In the treatment of visceral inflammations bloodletting held for long the leading place, and although the virtues it was said to possess are by many openly questioned to-day, there undoubtedly exist still certain conditions, the result of inflammatory hyperæmia, where its action is of signal benefit. That this should be so seems a natural inference when we recall the fact that in disturbed and perverted action of the vascular system, arise those changes which mark this morbid state, and that bloodletting exercises such power over the circulation as is unmistakable and undeniable. That the establishment of acute hyperæmia in the pulmonary area should exert a most pronounced effect on the whole vascular system, and that the action of bloodletting should, in this case, may be, best demonstrate its power is readily surmised.

The further fact, that the manifestation of this power is *immediate* renders it in such conditions as those to which reference will be made, of the very highest value. The little knowledge I have of its employment in pneumonia is in no wise sufficient to justify any expression of opinion as to its favorable effect upon the type, and the duration of inflammatory disease. All I wish to claim for it is its mechanical power of relieving suffering, of relieving blood-stasis, of restoring a lost balance between heart and arteries, and in this wise abating certain symptoms, the presence of which threaten very directly the life of the patient.

In pleurisy attended with grave inflammatory fever, with severe stitch, and with much difficulty in breathing, I have seen the most marked relief follow the practice of bloodletting. Now, however, that we possess in the hypodermatic injection of morphia so direct and so speedy a means of allaying pain, the temptation to use the lancet is not so great, for if there was *one* feature in the case which venesection did benefit, it was the intolerable suffering the patient was enduring.

I have a belief that the most dangerous forms of this disease are not those in which there is much effusion, rather are they marked by the exudation of lymph over a very wide area, and it was in the early days of such cases that venesection seemed to me to prove most beneficial.

Around the treatment of pneumonia has the dispute regarding the virtues and the evils of bloodletting raged most fiercely. This, to say the least of it, has been unfortunate, for, although there can be no doubt that indiscriminate bloodletting in pneumonia did an infinitude of harm, and ought, as a rule, to be entirely deprecated, there is still one form of the disease, and there are certain states which may arise in its ordinary course, in which to withhold its performance would be a grave error.

Let me, by the short narration of a case, illustrate the form of pneumonia in which, by its action, it may prove more than a mere alleviator.

A. H., a strong, muscular ploughman, had, by an unfortunate accident, the wheel of a heavily loaded cart "backed" across the right side of his chest. Five at least of his ribs were fractured; he had considerable emphysema, some pneumothorax, and pretty profuse hæmoptysis. Thirty-six hours after the receipt of his injury he was found with all the symptoms of acute pneumonia. He had grave inflammatory fever, his temperature was high, his pulse hard and full, he had an incessant short cough, and much difficulty in his respiration. That this difficulty was in a measure brought about by the pain attending upon the increased respiratory efforts was very apparent.

It was impossible to examine satisfactorily the anterior part of the chest, but behind, he had over a wide area very decided dulness upon percussion, with harsh respiration. I bled him freely from the arm, with great and immediate relief. Within the next twenty-four hours his pulse and temperature fell quickly, and although his lung afforded evidence of more or less consolidation for some days after, it never, I believe, reached the stage of true hepatization.

That in this case bloodletting, by the power it exercised over the distribution of blood, carried relief to the pulmonary circulation, which, through the operation of various factors had become overcharged, and thus assuaged dangerous symptoms, is fairly certain.

Wide, and great, as the difference undoubtedly is between pneumonia following an injury, and the disease as we meet it in the ordinary way, and certain as is the tendency it often has, when appearing in this shape, to terminate life by asthenia, we may witness ever and again in its course such conditions as demand for their relief that promptitude in action which bloodletting alone can bring, and here again I will make use of a clinical note.

B. G., a healthy lad of twenty, was the subject of right-sided pneumonia. For the first five days of his illness matters went fairly well with him. He had a quick pulse, and a high temperature, but his respiration was not more rapid, or more distressing, than the pretty complete involvement of nearly his whole right lung readily explained.

On the sixth morning, however, the aspect had changed—he was struggling for breath, his face, his lips, and his tongue were livid, his pulse was quick and small, but *he had a strongly beating heart* and copious pneumonic expectoration. Examination of the back of his chest revealed the fact, that in addition to the harm in his right side, he had now fine crepitation over the left base, proving that both lungs were implicated. He was at once bled to ten ounces and with immediate relief. Stimulants and liquid nourishment were given him with a free hand, his poultices were continued, and he ultimately made an excellent recovery.

The explanation of the sudden gravity of this man's condition lay in the occurrence of over-distention of the right heart, the direct sequence of that further obstruction in the pulmonary circulation which the congestion of the left lung had brought about. The feebleness of his pulse at the wrist, proof of the small quantity of blood pouring into the left ventricle, and the violently acting heart excited by the presence of an unwonted amount of blood, and doing that which in it lay to overcome an obstruction which threatened the extinction of its action, formed the best and the surest indication for the abstraction of blood. Vigorous as a heart may be, and capable in ordinary circumstances of contending for a time with stasis in the pulmonary circuit, there can be no doubt that in the pyrexia which marks the pneumonic process, we have that which, by favoring the occurrence of rapid dilatation, renders the struggle more doubtful, and the necessity for immediate action more imperative. For this reason it is that in extreme dyspnœa, and when there is evidence of a lost balance between the right and left heart, a remedy which like bloodletting is proximate in its action, is of the very highest value.

Prevalent as is pneumonia, and frequent as are the opportunities afforded to the practitioner for observation of its treatment, the occasions are very few, and very far between, in which bloodletting is demanded.

It is, however, otherwise with another disease of the lungs—acute pulmonary œdema—suffocative catarrh.

I am not aware that the essential pathology of this condition is fully determined. It is often so sudden and so swift in its onset, so evanescent in its existence, attended by so little constitutional disturbance, and withal so grave in its possible results, that it may well be a neurosis—vasomotor in its seat, and having for its characteristic feature the rapid outpouring of mucus into the smaller bronchi. It very usually arises from exposure to cold during the existence of a bronchial catarrh, and it is strongly predisposed to by the presence of disease of either the heart or kidney. In both these morbid states there doubtless exist such vascular conditions as influence gravely the mechanism of the pulmonary circulation, and dependent, mayhap, upon this fact rests the value of bloodletting in its treatment.

How great that may be, this case will best explain.

A gentleman, past middle life, consulted me some time ago on account of dyspnœa on exertion. He had been quite well until a few months before he visited me, when, without warning of any kind, he had an attack of pulmonary apoplexy which nearly proved fatal. His pulse struck me as hard and tense, and his heart-action as too forcible, although there was no very decided increase in the cardiac dulness. There was, however, a marked impurity and prolongation of the first sound at the apex, and a certain heaving action in this situation. The second sound at the base was markedly accentuated.

I examined his urine with care—it was of acid reaction, of good specific gravity (1.025), and was free from albumen.

I was puzzled, for I expected to find evidence of a granular kidney, and failing in this I fell back upon the hypothesis that he might possibly have slight mitral stenosis.

Uncertain on this point, and still believing that arterial tension was playing a part in the production of his symptoms, small doses of calomel were prescribed, and he was carefully dieted. From time to time he called upon me, and his record was one of improvement. Then at midnight on the 16th of October I was sent for hurriedly, and found him extremely ill. He had caught cold a week before, and had had more or less cough. On the afternoon of his attack—a cold, raw day—he had driven many miles in an open carriage. Up to the time of his retiring to rest he made no complaint, but as sleep was about to overtake him, he was suddenly roused by a feeling of intense dyspnœa. Living as he does close by me, I was soon beside him. He was propped up in bed, and wheezing loudly; his face was flushed, his expression anxious, and while he breathed with great difficulty, he expectorated from time to time the reddish mucus characteristic of suffocative catarrh. His pulse of 80 was hard and laboring, but his heart's action was not perceptibly increased, either in rapidity or in force, and his chest, clear on percussion, was filled with mucous and submucous râles, with an entire absence of vesicular murmur. Short time as the attack had lasted his condition was too grave to be benefited by the use of expectorants, and I made preparation to give him a subcutaneous injection of apomorphia. The advance of the disease was more rapid than my action, and he quickly passed into that state of semi-consciousness when the action of emetics is neither so prompt nor so satisfactory.

Dr. Lockie, for whom I had sent, now joined me, and we happily agreed as to the employment of bloodletting; he however remarked, and I quote his words to mark the gravity of the case, "bleed him or not he will die." He was now more or less unconscious, he was livid in color, and his heart, quickening in action, was unquestionably failing in power.

The opening of a vein in the left arm, performed in the usual way, proved futile, for the blood was so thick and tarry that it would not flow from it; so dissecting down upon the right median basilic, and exposing its surface clearly, I made into it a long and free incision. By constant pressure and friction the stream began, slow at first, and then more full, and when a pint of blood had escaped he expressed himself as "beginning to be relieved." Another pint was taken, and as the arm was being bound up, he said, "I am quite well; I could rise and walk." Within thirty-six hours, and without the occurrence of much expectoration, all râles had disappeared from his chest, and he was in his usual health. Since then he has had another similar attack, not attended, however, with quite such peril, for he was seen early, and he was bled to twelve ounces. The relief obtained upon this occasion was as striking as it was upon the previous one.

Now, his case is clear, there is a trace of albumen in the urine, there are to be found a few granular casts, and he presents unmistakable evidence of considerable arterial tension.

In cases such as this, where the advance of disease outstrips the action of all ordinary remedies, the immediate effect of bloodletting touches the miraculous.

To the good it can accomplish in cases of mitral stenosis, when, under certain circumstances, the chronic condition of distention of the right ventricle, always more or less in existence, becomes suddenly aggravated, I can bear no personal testimony; but the want of it is of small moment when I can refer for confirmation to the writings of Broadbent, of Chambers, and of many other able physicians.

Here, however, I would add an interrogatory note.

It is well known how much Dr. Angus Macdonald ("Heart Disease during Pregnancy") did to bring into recognition the peculiar dangers attendant upon cardiac disease in childbearing women, and how valuable are his records of the unfortunate progress of some of these cases. In one such, not however under my own care, in which mitral disease and pulmonary œdema brought about a condition of extreme gravity during labor, venesection proved of the greatest benefit, and I have a belief that I have seen relief to the struggling action of the diseased heart brought about by the increased tension accompanying delivery, follow the occurrence of a somewhat free post-partum hemorrhage. It is quite possible, then, that venesection might relieve the serious symptoms which, in such circumstances, at times *immediately* follow delivery.

Among the new phrases which mark the advance of the science of medicine there is none better known than that of "arterial tension," yet some accept its existence with reservation, and incline to believe, that as its presence is not easily refuted, and is often more a matter of opinion than demonstration, it is a *modern* term apt to be used with too convenient a looseness. It seems to me, however, that in the recognition of that hard, incompressible character of the pulse, which formerly led so often to the practice of venesection, lies the demonstration, that although lacking that full knowledge of the dangers which, to us, this condition portends, arterial tension has long been regarded by the profession as one of the states which bloodletting can successfully combat. And so it remains, for, spite of the teaching of Foster, that moderate bloodletting does not reduce blood-pressure, there is ample clinical evidence to show that it possesses the power of relieving those urgent symptoms which are the direct issue of acute increase in vascular tension.

High arterial tension is most familiar to us in connection with renal disease, and some of the most formidable states which arise in its course have probably a very close connection with its existence.

The pulse in some cases of acute Bright's, and in granular disease of the kidney generally, has very special characteristics, and when, as time runs and under the retarding action of the muscular arterioles pressure in the arteries rises high, its cord-like feeling in unmistakable. Then it is, I believe, that convulsive phenomena are most apt to make their appearance, and in certain cases imperatively demand for their relief the employment of general bloodletting.

How valuable this may prove, the following case, the last of its kind which has come under my observation, and belonging to a group well known to most practitioners, albeit the subjects are generally of more tender years, will show.

Some little time ago I saw with a practitioner in a neighboring county, a gentleman suffering from scarlatinal nephritis. He had been ill for three days when I was asked to visit him, and he had been treated in the most judicious way. He had been purged, had hot air baths, had pilocarpine injections, and such a diet as was best suited for him. Still he did not improve, his urine was exceedingly scanty and highly albuminous and a complaint of some dimness in vision made his attendant anxious about him. At the time we entered his room together he was in a violent convulsion, a foreboding of which occurred about an hour previously when he became suddenly quite blind. When the violence of the seizure had passed he was deeply unconscious, pale in the face, with a small pulse at the wrist, hard, however, and unyielding as whipcord, and with a forcibly acting heart, of which the sounds, both at base and apex were highly accentuated. With the acquiescence of his doctor I bled him freely from the arm, and with such benefit that in a little while he became conscious and made complaint of headache. Two hours after we left him he had another but much milder fit, in the struggles of which the retaining bandage on the arm became undone and he sustained a further loss of blood. This, however, did him no harm, for when his attendant, sent for hurriedly to visit him, arrived, he found him fully conscious and free from discomfort. This condition happily proved permanent, there was no recurrence of the convulsion, and he made, thanks largely to the bloodletting, an unusually rapid and satisfactory recovery.

A case of renal disease such as this, is typically the one in which bloodletting may be employed without hesitation. The condition which has led to the production of the convulsion is acute in character, it has been but a short time in existence, there is no preëxisting impoverishment of the blood, and nothing of that deep undermining of the strength which marks the chronic Bright's. Apart altogether from the unmistakable relief to the convulsive disturbance which venesection in such circumstances usually brings, there is the further possible good it confers upon the general state of the patient. It is not often that now we treat inflammation as such by the abstraction of blood, and yet I venture to believe that in acute nephritis, occurring in a robust and healthy subject, there is no line of primary treatment more likely to prove beneficial than venesection. My reasons for thinking this are twofold: one the knowledge that in some instances death has been the direct and rapid result of such cardiac harm as is brought about by the sudden occurrence of acute arterial tension; and the other, the observation, frequently repeated, of the immense benefit which has followed the occurrence of a smart attack of hæmaturia. There is probably no organ in the body in which vascular pressure is so consistently high as in the kidney, and none in which bloodletting has more decided effect, as witness the benefit which follows its practice in certain cases of severe renal hemorrhage.

In dealing with convulsions in cases of chronic diseases of the kidney in some of which it is of striking value, we require to be more guarded in its employment. Here two points are worth remembering. The one, especially applicable to such cases, is the dictum of Graves in connection with bleeding, that "you may rely on it that every ounce of healthy blood you take away is shortly replaced by two ounces very inferior in quality," and the other, that an impoverished condition of the blood is a factor in the production of uræmic convulsion, and that bloodletting by producing this state may predispose to future attacks. In some patients, however, enfeebled beyond all doubt, in whom convulsions have their origin in local cerebral œdema, its occurrence marked, it may be, in addition by the presence of hemiplegia, a small bleeding of one ounce or two may prove of the greatest benefit. It is no doubt difficult in some instances to diagnosticate the morbidness which underlies the state of the patient from that of cerebral hemorrhage, but where convulsions are recurring, and the temperature is subnormal, it is wisest to let blood.

In very intimate—in almost inseparable—relation with the convulsions to which I have referred, are those observed in the pregnant and parturient woman. It has sometimes occurred to me that the bond of relationship which binds them most closely to one another, is that of high arterial tension. I have witnessed most severe eclampsia in a case in which there was comparatively little albuminuria, and if we estimate —and I believe that in such cases it is a pretty reliable guide—the extent of damage to the kidney by the amount of albumen thrown down, then we must look for something besides the renal mischief to account for the production of convulsions.

This, I take it, will be found in that normally existing state of pronounced arterial tension which is the constant accompaniment of gestation. The presence of cardiac hypertrophy, increase in renal pressure, increase in the quantity of blood, and probable increase, as mooted by Barnes, in nervous force, all contribute to the production of increase in vascular pressure, and when, superadded to these many separate factors, we have nephritis—probably degenerative in its nature—bringing as its results not only a further and harmful increase in the quantity of blood in the vessels, but most marked deterioration in its quality, then it is readily understood how a minor degree of renal mischief may determine the occurrence of eclampsia.

The best known theories regarding the causation of puerperal convulsions have for their basis this excess in arterial tension, and therefore it might seem *à priori* that in such cases bloodletting would prove useful. And so it does in some, for although in the majority the use of chloroform, chloral, or pilocarpine, remedies possessing the power directly or indirectly of lowering vascular tension, may be found sufficient, there yet exists a minority of cases, in which the form and the gravity of the seizure demand for its safest treatment recourse to venesection.

Marked severity of attack, with extreme congestion of the face, and turgidity of the vessels, as its characteristics; and profound coma, with flushed face, and a hard, long pulse, in the intervals of the seizures, form, maybe, the most reliable guides for such treatment. I well remember one such case, a primipara seized within an hour of her delivery with convulsions of such frightful severity as to render their remembrance with me indelible, and how, after chloroform had been used without avail, a free venesection altered at once the whole aspect of her condition. I am happy in this experience, that although all the cases I have seen were not treated by bloodletting, those which were, and these the most severe, made excellent recoveries, and whether due to the fact that such treatment tended to the more speedy cure of the kidney disease, or that they lacked a vital tendency to its development, they all escaped what unhappily came to some of the others, recurrent puerperal nephritis, with its sad tale of disaster.

The importance attaching to the condition of high arterial tension becomes increased by the knowledge of the fact that it may exist independently of disease of the kidney, and that it may prove the cause of such convulsive phenomena as are indistinguishable in their characters from those that mark uræmia. That this depends upon the peculiarities of the cerebral circulation is most probable. It is not easy, as Broadbent has pointed out,[1] to say how convulsions are produced, but if we admit that acute increase in vascular tension has a possible power of causing anæmia of the brain with, perchance for its sequence, a serous effusion in the meninges, and that it may give rise to the occurrence of capillary hemorrhage in its substance, then we can understand how capable it may prove of producing such nerve storms as betoken the occurrence of some hitch in the circulatory balance of the great seat of nervous force. The harm to which it gives rise is, however, not always so startlingly evident, but it is none the less grave; cardiac disease, aneurism, arterial degeneration, these all follow in its train, and render it one of the conditions in which a ready recognition and a fitting treatment must go hand in hand. It has happened to me on several occasions to observe in elderly men, the subjects of gout, how much relief has been brought to somewhat indefinite but most troublesome symptoms by a smart epistaxis.

Last autumn I had under my care a gentleman of sixty, of well-marked gouty tendency, suffering from headache, giddiness, and extreme irritability of temper. He had all the physical signs of high arterial tension, but without evidence of any organic disease. He was treated by calomel and salines as active purgatives, and he was carefully dieted, but with little improvement, until the occurrence of a severe epistaxis brought him entire relief. Then I recognized fully how certainly a moderate bloodletting would have saved him suffering, and myself anxiety concerning him.

His was one of the cases in which there is no existing disease of the kidney, but in which a gouty condition of the blood, coupled maybe with a plethora, led to increase in arterial tension, and, as sometimes happens, to apoplexy as an unhappy sequel.

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[1] Lancet, 1883, vol. i. p. 4 et seq.

The term of gestation is not the only period in a woman's life when she may become the subject of high arterial tension. It may come to her in the earlier years which succeed the establishment of menstruation, through continued amenorrhœa, and it may, and very frequently does, during the epoch of the climacteric. Many of the very trying subjective symptoms of which bitter complaint is made at this especial time have their origin in vascular disturbance, and I have noted in some cases how relief to them most certainly followed the action of such remedies as render the pulse softer and more full. But its ill effects may be so pronounced as to endanger life. Here is an instance, the most pronounced I have ever seen, but fraught with instruction:

In the early hours of a morning in last June I received a note from Dr. Graham, of Kirklinton, asking me to see with him a patient who was thought to have had an apoplectic attack. She was a farmer's wife of forty-five, stout, red-faced, and plethoric. For nearly four months the catamenia, normally large in amount, had disappeared, and latterly she had been short-winded and her respiration very easily distressed. Her doctor had seen her on several occasions, because she had general malaise and headache, but there seemed nothing in her state to provoke anxiety. On the evening preceding my visit he had called, and found her much in her usual state, except that a slight menstrual discharge had made its appearance. At midnight she was discovered to be in a condition of profound coma, and in this state Dr. Graham found her. When we met at her bedside she was better, for she could be roused sufficiently to answer questions, but she was stupid and uncollected. The face was flushed and somewhat congested, her pupils dilated and inactive, her heart slow and heaving in its action, with a *clanging* accentuation of the second sound at the base, and her pulse was hard, full, long, and incompressible. There was a little discharge from the vagina and some urine drawn from the bladder contained a trace of albumen. The albuminuria rendered the diagnosis uncertain, but as the acuteness in arterial tension was unmistakable, we bled her freely from the arm. Nearly thirty ounces were taken and this without faltering of the pulse, and, indeed, before it became large and soft. Then she became fully conscious and made complaint of a little nausea. As her bowels were confined, a brisk saline purge was prescribed and a restricted diet. Next day, her doctor, long detained by matters obstetric, went with some anxiety to visit her. He found her downstairs presiding at the tea-table, perfectly hearty and well. Despite the facts that her appearance and her history negatived the existence of granular kidney, the presence of albumen in the urine rendered me at first suspicious, but it never could be detected at any subsequent examination, and when, a week or two ago, I made inquiry regarding her, I found her in perfect health.

That the albuminuria and the slight uterine discharge had a common origin in the high arterial tension, and that the state of coma in which she was found followed an unrecognized convulsion are sequences I think very probable. In the existence of acute vascular pressure lay the primary harm, and this harm bloodletting relieved in a manner with which no other remedy could cope. This relief was as evident and striking to those standing around as it was to the medical attendants.

That in cases depending upon menstrual irregularity the excess in tension arises from simple increase in the volume of the circulating fluid is, I think, likely; and hence, in some of them, as happened in the instance just related, bloodletting not only brings relief to urgent symptoms, but it effects a permanent cure.

Here may well end my quest. It is not without due deliberation that I have recorded these views with reference to the value of bloodletting, for, although there has been, of late, a decided reaction in its favor, there still exists a strong prejudice against it, and where many of the wisest and best hold opposite opinions it seems immodest to speak with decisive tone. And yet it is not necessary when we speak with decision to speak presumptuously. The opinions that are mine on this matter have grown slowly, and they, at least, have this possible merit, that as the result of experience and of thought they have become convictions. To some the premises upon which they are based may seem quite inadequate, and the views wrong, but I have, nevertheless, ventured to narrate them, because they are my firm beliefs, faith in which has stood the strong touchstone of practice.

It was a proposition of that wise physician, the late Dr. Peter M. Latham, that the groundwork of rational practice is to understand the value of single indications, and the power of single remedies; and as there seems to be no treatment for which the indications are so decisive —none in which a single one may more surely point the way than for bloodletting—and no single remedy which, in necessary circumstances, possesses so great a power, I will finish, and at the same time point the object of my paper, by a quotation from his writings: "I am persuaded," he says, "that when the physician is called upon to perform great things, even to arrest destructive disease and to save life, his skill in wielding the implements of his art rests mainly upon the right understanding of simple and single indications, and of the remedies which have power to fulfil them."

Carlisle.

PRECOCIOUS GUMMATA.[1]

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The close and widespread study of syphilis within the past fifteen years has conclusively shown that the old and dogmatic division of the disease into three sharply marked periods must soon be very much modified, or perhaps even discarded, and that, although the terms primary, secondary, and tertiary, as applied to stages of syphilis, present the advantage of clearness and simplicity in study and description, and may even be clinically true as regards a large number of cases, yet there are very many in which such a division is inappropriate, since we observe in some the so-called tertiary lesions in the secondary period; in others seemingly secondary lesions in the tertiary period, and perhaps coexisting with well-marked lesions of that period; or, again, cases of tertiary lesions concomitant with secondary lesions. To hold, then, that superficial lesions belong to and are only found in the early or secondary period, and that they are followed later on by lesions involving the tissues more profoundly, is in reality to sacrifice facts for simplicity of description. Indeed, one of the as yet unsettled problems of great importance in syphilology is that relating to its periods, classification, and chronology.

One of the main facts which militate against the old division is that which has been so prominently brought forward of late years, namely, that there are many lesions and affections which were formerly looked upon as belonging to the tertiary period, which are very frequently observed to assume a precocious development, appearing more or less early in the secondary period. Thus we not infrequently see within the first year of syphilis destructive ulcerations of various size and depth which we call malignant, precocious syphilides. Not infrequently do we meet with cases of osseous and articular lesions which, under the old division, we can only term precocious since they appear in the so-called secondary stage. Marked instances of early gummatous development are seen plainly in the gumma of the iris, and again severe infiltrations of the pharynx and larynx are not infrequently observed early in the first year of the disease. Then, again, observations made within the last decade have shown that affections of the nervous system, which at one time was thought to be spared by the syphilitic virus, and in later times attacked only in its tertiary stage, may develop within the first six months of syphilitic infection. In considering this subject of the relationship of secondary to tertiary lesions, that eminent surgeon, Mr. Jonathan Hutchinson,[1] says:

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[1] Read before the American Dermatological Association August 25, 1886.

> "What has been named a 'gumma' has been supposed to be characteristic of the tertiary stage. Opinions have, however, been changing respecting several, if not all, of these points. Cases have been recognized in which the various conditions referred to were met with so early in the disease, and in such close combinations with each other, that the only explanation seemed to be that the disease had run an unusually rapid course, and had reached its last stage before it had well finished its first. By degrees we are, however, arriving at another interpretation of such facts, and are beginning to see that the old classifications of the phenomena cannot hold their ground, and that we must seek for other characters by which to distinguish the secondary and tertiary stages. Not, indeed, that the old observations are wholly wrong; this would be exceedingly improbable, and its mere assertion would very properly lead to much distrust of any modern conclusion which might seek to supplant them. Speaking loosely, and in a general way, it is still true that visceral affections, gummata, deep ulceration and periostitis belong to the tertiary stage. It is only when these facts are brought forward as if they were constant and sufficient in themselves to form the basis of classification, that we are compelled to make protest."

He then continues:

> "Permit me to illustrate what I mean by the citation of a case. A young man, aged twenty-one, too young, let me note, for it to be likely that he ever had syphilis before, was admitted into the London Hospital under my colleague, Dr. Langdon Down. He had still the remains of a hard chancre on him, and he was covered by a papular rash, which was ulcerating in places. The date which he assigned to the beginning of the affection was only four months previously. He died suddenly and unexpectedly. The necropsy showed gummata in both testicles, in the spleen, and in the heart, death having been caused by the softening and ulceration of the latter."

Though Mr. Hutchinson thus shows the shortcomings of the old classification of syphilis, he does not attempt to establish a new one. In this he is, in my judgment, wise, seeing that in our knowledge of the natural history of syphilis there are yet many lacunæ, notably in that of early visceral lesions. In Germany, also, the insufficiencies of the old classification have been treated of in an excellent article by Finger,[2] who, however, has no new one to offer.

Though to-day there are comprehensive descriptions of precocious nervous, osseous, articular, ocular, and superficial ulcerative dermal affections due to syphilis, a systematic description of the clinical history of precocious gummata is wanting.

It must, in justice, here be stated that our knowledge of many of the precocious affections of syphilis is in a large measure due to the writings of that eminent syphilographer, C. Mauriac. His paper, entitled "Cas de syphilis gommeuse précoce et refractaire à iodure de potassium," Paris, 1874, is, according to my reading, the first contribution to the subject of precocious gummata, and this, with his latter paper, "Memoire sur les affections précoce du tissue cellulaire subcutanée,"[1] constitutes up to this time the literature of this form of eruption.

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[1] Lettsomian Lectures on Some Moot Points in the Natural History of Syphilis. British Medical Journal, January 23, 1886.

[2] Ueber die Koexistenz der sogenanten secundären und tertiären Syphilisformen. Wien. med. Wochenschrift, Nos 1 and 3, 1882.

In the present essay the divisions and clinical descriptions are based wholly on my own observation and study during a period of many years, aided at times by the facts observed by Mauriac. In many points my experience accords with that of this painstaking observer, while in others it is more or less at variance.

I propose to present the clinical histories of a selected number of my cases, from which I think I can trace a clear and satisfactory description of these not common nor yet infrequent eruptions.

My studies have convinced me that there are three forms of the precocious gummata: The first, the generalized form; the second, the localized form; and the third, the neurotic form, which in some of its features resembles erythema nodosum. Of each of these three forms, moreover, there are two varieties: a resolutive, or non-ulcerative, and an ulcerative variety.

I. The Generalized Form of Precocious Gummata.

A clear idea of this form of syphilide is presented by the following case:

Case I.—A merchant, aged thirty-six, came under my observation in May, 1885. He was a tall, thin man, of exceedingly nervous temperament, never very strong, who continually overtaxed himself mentally and physically, and subordinated to business every pleasure and relaxation. Excepting several attacks of gonorrhœa, and more or less prolonged periods of extreme debility, he had had no real sickness in his life. He came of excellent stock. In January, 1885, he had a large indurated chancre, with marked inguinal adenopathy, which was followed late in February by a roseola and papular syphilide, fall of hair, rheumatoid pains, emaciation, and asthenia. For these he had been treated by an out-of-town physician in a proper manner.

Late in May, three months after the evolution of the secondary period of syphilis, he came to me, at the advice of his physician, presenting the following symptoms. On the scalp a tendency to loss of hair, mucous patches in pharynx, and over the body a declining papular syphilide, interspersed with slight maculations of what had been a deep-tinted roseola. Amid these retrogressing lesions was the eruption which is of interest in this paper. Over the nucha and the shoulders, on the outer aspect of the arms, particularly over the elbow, over the gluteal region, quite copiously on the outer and anterior part of the thighs and legs, and sparsely on the inner aspect of these members was scattered an eruption of tubercles, varying in size from a lima bean to a walnut, which numbered by actual count more than forty. These tumors were seated firmly in the skin, involving its whole thickness, besides some of its underlying connective tissue, were easily movable, and sharply circumscribed. They were of a dull red color, some of them level with the plane of the skin, while others, and particularly the larger ones, were in a moderate degree salient. They were in general covered with normal epithelium.

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[1] Annales de Dermatologie et de Syphiligraphie, 1880 and 1881, and Leçons sur les Maladies Vénériennes, Paris, 1883

Amid these well-developed tumors were fully fifteen very minute ones, of which several could not be seen by the naked eye, but on searching for them presented to the tip of the finger a feeling of movable, circumscribed infiltration in the deeper portion of the derma. Others of these incipient tubercles, being like those just described, of the size of a pea, showed, upon examination, that they were infiltrations which had begun coincidently in the skin and connective tissue, while it was evident that in the former the morbid process began in the superficial layers of the connective tissue, and that they gradually contracted adhesions with and invaded the whole derma. The only further point of interest of this case in this connection, is that a few of the larger and older tubercles underwent slight and superficial ulceration, while the majority were cured by local and constitutional treatment within a month.

The period of time occupied by the evolution of the eruption up to the date of my first examination was, as nearly as could be determined, two weeks. During the whole course of the eruption the subjective symptoms had been very slight and were limited to a feeling of slight uneasiness and impediment to locomotion.

I may here add that the question in the mind of the attending physician, who was a very intelligent man, I only seeing the case at varying intervals in consultation, was, whether the eruption I have just described was really of syphilitic origin, or whether it was a coincident furunculosis of low grade and of aborted form. He very pertinently remarked that it seemed strange that such superficial lesions as roseola, papules, etc., should be followed so quickly by lesions so deep-seated as were these gummatous infiltrations.

The foregoing case may be taken as typical of the first, earliest, and most common form of the precocious gummata. It will be noted that while in its general and symmetrical distribution the eruption presented the features of the early and, we may perhaps say, exanthematic syphilides in the intensity and profundity of the morbid process, it partakes of the character of the late or tertiary lesions. In my experience this particular form of eruption, while not rare, is not very common. I usually see four or five of such cases every year in hospital and two or three in private practice.

These cases present considerable uniformity, and although to the experienced physician they usually offer no difficulty of diagnosis, I have often seen them prove stumbling blocks to the younger men and sometimes even to older ones.

This eruption may appear as early as the second month, and in the third, fourth, and sixth. I have observed that the earlier the date of the appearance in general the more extensive is the eruption and the more numerous the gummatous tumors, and that while it is the rule to see many of them, thirty, forty, or even sixty or seventy, cases will be observed when as small a number as fifteen or twenty tumors are present. Not infrequently do we see the evolution of the eruption following or even coincidently with the existence of a general roseolous, a papular, or even pustular syphilide. It is not uncommon to find coincident gummy infiltration into the pharyngeal walls or into the mucous membrane of the roof of the mouth, or even less intense lesions of these parts. Serous and gummous iritis, neuralgic phenomena, even such grave affections as hemiplegia, paraplegia, and minor palsies may also be observed to be coincident with or follow closely upon the evolution of this eruption. Many observations which I have made have convinced me that in most cases there is an accompanying well-marked febrile movement just preceding and during the outbreak. In some of the milder cases the temperature may be elevated from one to two degrees, while in others, particularly in those of extensive eruption, the thermometer registers in the evening 102° or 103° F., with a decline of two or more degrees in the morning. Then, again, the fever may be slight and continuous, while in cases attended with much cachexia, a continuous high fever is occasionally observed.

This form of gummatous eruption attacks both males and females in about equal numbers; my own observations tend to convince me that some condition of lowered vitality or impaired nutrition is at the root of it and of other forms of early gummata. Thus I have met with it in persons of naturally poor fibre, in those of studious and sedentary habits, in persons exhausted by the cares and confinements of business, and last, but foremost, in those who are habituated to the excessive use of alcoholics. If the question was put to me, "In whom do you most frequently observe severe and precocious syphilides?" I should answer promptly, first, in those whose nutrition is impaired by alcohol; second, in those who suffer from renal and hepatic diseases; and, third, in those having these visceral lesions and, besides, who have been addicted to alcoholics. I am not as much impressed as some observers are as to the malignancy of syphilis in strumous subjects. Very many such patients become sorely afflicted by syphilis, yet in many that disease runs its course unattended by severe precocious lesions or even with late lesions of much severity. I have reached the conclusion from extended observation that in the so-called scrofulous person, provided his or her habits of life are good, there is not an unvarying tendency to malignant precocious syphilis. It is true, I have seen early and malignant forms of syphilis in strumous persons, but not in such numbers as to warrant me in placing struma in the front rank of its causes.

This form of eruption is found in both old and young, though my statistics show that the greater number of my patients were between twenty and thirty-five and after fifty years. My opinion is in accord with most syphilographers that syphilis in persons beyond fifty years of age is frequently severe; that its lesions are often precocious, grave, and extensive; and that the diathesis has a tendency to modify, to engraft itself upon and often to intensify previous morbid processes or affections, local or general. I have repeatedly seen instances of this malignant action, and I have very frequently seen the form of precocious syphilide now under consideration in old subjects.

Malaria very frequently acts as a formidable complication of syphilis, and some of the most rebellious cases that I have treated were in persons whose systems, prior to syphilitic infection, had been debilitated by its virus. In such cases I think that we more frequently see precocious cerebral and nervous symptoms, and not infrequently early hepatic disturbances, of greater or less severity. In these cases of mixed diatheses, however, the syphilides often run an active and severe course, and precocious gummata not infrequently attack them.

The clinical history of this form of precocious syphilide then is as follows: As early as the eighth week of infection, rarely earlier, the patient notices either small circumscribed swellings under the skin, generally unattended with pain and only perceptible to the touch, or this stage of the eruption may escape him and his attention is at first arrested by a number of bright red spots. Quite frequently the patient comes with the statement that blind boils are breaking out all over him. Examined early in their history these gummata are found to be round tumors of the size of a bean, deeply set in the skin, having a bright red color which, at the first, is dissipated by pressure, but becoming deeper, more sombre and permanent in color later on. They increase peripherally quite rapidly, so that within a week or ten days they may attain an area of an inch, or an inch and a half. Then again their growth may be slower. In general a goodly number of tumors appear scattered symmetrically over the whole body. As they grow they are followed by new ones which come along with greater or less rapidity, in proportion as internal medication is pushed. If a correct diagnosis is at once made and appropriate treatment instituted, the first crop may be the only one and that may be promptly dissipated. Unaffected by medicine, their evolution continues and in a fortnight the arms, forearms, perhaps the scapular region, not infrequently, but not as a rule, the back and anterior surface of the trunk, the gluteal regions, thighs, and legs are invaded by these tumors.

The course of these gummata is, in general, quite regular and not subject to great variation. When developed they present a quite firm sensation and this may be termed the period of condensation. As they grow older the red color becomes rather coppery, and while the periphery of the tumor may or may not seem firm, the central portions appear softer to the touch, conveying the impression that the tissues are permeated with a thick fluid. This we may denominate the stage of softening, and is found to be of varying degrees in different cases. In some instances there is simply a soft and yielding sensation conveyed to the finger tip, while in others a feeling of slight fluctuation is noticed. To the inexperienced in the latter case these tumors may give the impression of being abscesses and suggest the use of the knife. But such a procedure should not be resorted to, since resolution may take place under the influence of treatment, even when the condition of softening is well marked. In the majority of the cases there is not abscess formation, but rather a liquefaction of the gummy infiltration, which is in general promptly absorbed. In the non-ulcerating or resolutive variety of precocious gummata, which we are now considering, the further progress of the tumors is as follows: They gradually become flatter, the borders melt away slowly, and the color *pari passu* fades until the normal hue or a coppery pigmentation of the skin is reached, which occurs soonest on the trunk and upper extremities and latest on the legs. On the latter situation the stage of softening may continue until the stage of ulceration sets in. Here, also, these tumors frequently take on inflammatory action when complicated with varicose veins, with œdema and chronic eczema and erysipelas. The time occupied in the full development of these tumors is usually from ten days to two weeks, and after that their period of duration is variable. They may, under treatment and care, promptly retrogress, and again may remain in an indolent condition in the second stage indefinitely. The traces left by them are generally very slight and not permanent, being simply slight hyperæmia and scaling and coppery pigmentation. Then again, in long-standing resolutive cases, after absorption has taken place distinct loss of tissue may be noticed in a depressed cicatrix, which, however, is not as profound as those left by the gummata of later periods. Not uncommonly, new and sparse crops of tumors appear while the general eruption is in process of absorption.

Having thus quite fully described the non-ulcerative or resolutive form of this very precocious gummatous eruption, a few words will suffice to bring out the features of the ulcerative variety. While in the first variety there is usually little or no tendency in the tumors to necrobiotic action, in the second variety this condition is seen quite early. The stage of condensation is very short, and softening in a marked degree is observed in a few days. The centre of the tumors assumes a dark red color in one or in several spots, and a sensation of fluid under the epidermis is distinctly made out. Then slight ulceration may occur in spots, often at the openings of the hair and sebaceous follicles, and very soon the epidermal roof of the tumor melts away, and we soon see the gummatous ulcer with its slightly thickened, reddened, undermined, and perhaps everted edges, and its floor of a greenish-red, bathed in an unhealthy sanious pus. As a rule, however, these ulcers are more superficial than the later ones. Their floor is less deep, the edges less undermined and everted, and the whole appearance indicates that the destruction is less profound. I have seen instances of this variety in which as many as forty tumors underwent degeneration.

Having reached the stage of ulceration, the further course is indefinite, and it depends entirely upon the treatment, external and internal, which is adopted. The concomitant symptoms of this variety of the gummous syphilide are in general like those of the resolutive variety, only that they are usually more intense and accentuated. The fever is higher, the malaise more pronounced, and the general condition of the patient rather worse.

Usually there is no difficulty of diagnosis of this variety of precocious gummata. The infection is so recent that a history of syphilis is easily obtained and then all doubt as to the nature of the tumors is removed. I have seen them, however, mistaken for aborted furuncles and regarded as rheumatic tumors, as scrofulous swellings, and in a case in which the initial lesion was seated on the index finger and was accompanied by severe constitutional symptoms and an active angio-leucitis of the arm, they were thought to be the result of purulent infection.

II. The Localized Form.

The second variety of precocious gummata usually appears somewhat later than the one just described. In exceptional cases I have seen the eruption as early as the third month of syphilis, though my notes show that in the greater number of cases the date of appearance was the fifth, sixth, or eighth month of infection and even as late as one year. Like the first variety, the evolution of these tumors is aphlegmasic, rather more insidious and indolent than that of the first variety, and, in short, partaking of their characteristics to a certain extent and, also, of those of the gummata of the tertiary period.

In the second variety, also, we find some cases in which resolution takes place, while in others the stage of softening goes on to ulceration. While in the first variety the tumors are smaller, more numerous, and more copiously and symmetrically distributed, in the second they are, as a rule, larger, less numerous, and, though generally symmetrically placed, occasionally they are unsymmetrical, existing upon one region and absent on its fellow of the opposite side.

As a rule, they are met with in the same class of persons as the first variety is, namely, in the aged, and those given to excess in alcoholics, in persons of strumous tendency, in subjects debilitated by any exhausting cause or adynamic influence, such, for instance, as visceral disease, fevers, pneumonia, diphtheria, etc., and in those reduced by chronic malaria. Then, again, I have seen this eruption in patients who could not be classed in any of these categories, who had never had any sickness—yet, as they remarked, had never been strong; in short, persons of poor fibre. While there may be a slight prodromal or accompanying fever, it is usually absent, and the patients may not complain of any unusual intensification of their morbid condition.

The following case will answer well as a prototype of this second form of precocious syphilide in its full development; while very brief notes of other cases will be of service in showing its more restricted and less symmetrical distribution.

Case II.—A female, aged twenty-four, a blonde, fat and flabby, came under my observation at Charity Hospital in October, 1883. She had been in the hospital at different times for gonorrhœa and chancroids, was a woman of the town, and addicted to drink and dissipation. In April, 1883, she had an insignificant ulcer at the fourchette, which was followed by inguinal adenopathy, fall of hair, a severe attack of mucous patches of mouth, throat, and larynx, and a disseminated and very copious papulo-pustular syphilide. She was treated at a dispensary, but was negligent in following advice, and generally careless of her health. In September, five months after infection, she presented evidence over the whole body of a small miliary papular syphilide.

She entered the hospital on account of a number of tumors on her legs which began to appear about a week before. At the examination I found, on the outer aspect of the forearms, over both gluteal regions, and on the lower half of the leg, a number of tumors. These were oval in shape, following the longitudinal axis of the limbs, but obliquely transverse at the gluteal regions, slightly elevated, and were felt to involve the whole thickness of the skin, and part of its subcutaneous tissue. Their color was a pronounced red, tending toward brown; they were covered with a tolerably perfect epidermis, and surrounded on the legs by a bright red areola. Elsewhere the deep red color of the tumors stopped sharply at their borders. The largest of them, which were on the outer side of the legs, were about two and a half inches in length, by one and a half in breadth, while the others varied in size until the smallest were reached, which were less than an inch long. In all there were about fourteen. The woman's stomach was so much deranged, and her health so debilitated, that mercury in any form, or by any method of administration, was temporarily out of the question. The treatment was, therefore, directed to improvement of the appetite, and invigoration of the system.

While under this course, several subcutaneous tumors developed quite quickly, say within ten days, on the outer aspects of both the forearms and the legs. They could be distinctly felt at first as localized, sharply limited infiltrations, without any subjective symptoms whatever. In this condition they were followed carefully from day to day, when in two weeks they had attained an area of an inch and a half by one inch, having in the meantime fused themselves with the skin lying above them, and come to present features essentially like those of their predecessors. The patient presented very slight febrile symptoms, complained of no pain, but simply a tense feeling in the arms and legs. Later on, under a mixed treatment, these tumors slowly disappeared, having in the meantime been increased by the addition of four more. In their fully developed state—that is, when about two weeks old—they were hard and firm, but later on, they became softer, especially in their central portion, producing a very slight sensation of fluctuation, or, perhaps, I might say, bogginess of the tissues. They never advanced toward ulceration further than this. The redness grew more brownish, and then gradually faded, until at last, in the more dependent ones, slight pigmentation remained, while, in the remaining, total resolution occurred without leaving any trace. The patient was under observation for ten weeks.

In contrast with this case of general and symmetrical distribution, the following are of interest:

Case III.—A female, aged twenty-nine, in the seventh month of syphilis, had several such tumors on the right leg, two on the left arm, and two on the scalp, over the right temporo-parietal region.

Case IV.—A man, aged twenty, six months after infection had several tumors on the legs, one on the right side of the forehead, and one on the chin.

Case V.—A female, aged forty-five, in the tenth month of syphilis, had several tumors on the outer side of both forearms, and one on the left parotid region and infiltration into the soft palate.

The clinical history of this variety of gummatous syphilis is so similar to that of the first that extended description is unnecessary. The appearance of the tumors is the same, except that they are usually larger, perhaps not as much elevated as those of the first form. There is the same stage of condensation, which is slightly longer, then follows that of softening, which is even more aphlegmasic than in the first form. On the legs such complications as chronic eczema, phthiriasis, œdema, varicose veins, and erysipelas, often much modify and intensify the course of these tumors. If resolution takes place, the same process and features are observed as I have already described. If ulceration occurs we find the same softening in one or more central spots, which become of a deep red or black color, then the gradual melting away of the skin until the well-marked gummatous ulcer is left. As in the first variety all the tumors may undergo this necrobiotic action, so in this form one or more may thus succumb, and generally those on the legs. The resulting ulcers are usually large and deep, and correspondingly slower in healing. On the legs this eruption is frequently accompanied by a sensation of uneasiness and heat, and locomotion is more difficult. Elsewhere little, if any, discomfort is experienced, except on the forearms, where a feeling of tension is often complained of.

In general, the diagnosis of this form of syphilide is easy, particularly when the tumors are numerous, and symmetrically distributed. In the cases in which the tumors are sparse and localized, errors in diagnosis are not infrequently made. It is important to bear in mind that the regions of the head and face are particularly susceptible to this form of precocious syphilide. When thus seated in these regions it is quite frequently found that there is also infiltration into the pharyngeal walls, and perhaps into the mucous membrane of the mouth.

I would not be understood as limiting the date of evolution of this syphilide to the first year of syphilis, since it unquestionably appears later. As the diathesis grows old, however, the eruption generally is less copious, less symmetrical, and is more insidious, aphlegmasic, and limited in extent, becoming more and more like the tertiary form.

III. The Neurotic Form, Presenting Points of Resemblance to Erythema Nodosum.

Case VI.—A female, thirty-seven years old, married, mother of three children, having suffered from eczema and severe attacks of supra-orbital neuralgia, accompanied by gastric disorder for years, was infected with syphilis by her husband in the winter of 1881. She was a thick-set, fat, and phlegmatic lady, and had never been robust and strong. The secondary manifestations were quite severe, a roseola being soon followed by a copious papular syphilide, distressing angina, and rheumatoid pains. She lived in a neighboring city and was carefully treated with mercurials by her family physician.

In the month of February, 1882, she was brought to me and presented the following symptoms: She had complained of excruciating nocturnal cephalalgia for about ten days. The cervical, epitrochlear, and inguinal ganglia were much enlarged and over the arms and trunk was a declining papular syphilide. The chief object of her visit was to determine the nature of a number of swellings on various portions of the body. On the outer aspect of the shoulders were several oval tumors of a bright rosy red, slightly elevated and convex, having a firm consistence and sharply marginated. Their length was three-quarters of an inch, their diameter half an inch. On the infra-clavicular regions were two tumors, symmetrically placed, slightly larger than the others, and on each forearm were two similar tumors. On each of the legs, on the antero-external surface, were several more of larger size, distinctly elevated, flat, and surrounded by an œdematous margin. Their surfaces were firm and the epidermis quite tense. The color was of a sombre red. The story told by the patient was, that ten days previously, when suffering from severe headache, which was worse at night, she noticed a sense of heat and a soreness as if from a blow or a bruise in the forearms, shoulders, and more severely in the legs. On rubbing these regions she felt lumps under the skin, which, in two or three days, developed into the red tumors just described. While these tumors were forming she was further affected with lancinating pains of intermittent character in the outer aspect of both thighs, beginning at the anterior superior spine of the ilia and running down to the knee. Examination at the time showed that under the skin, on the antero-external surface of both thighs, were two irregular oval plaques of induration fully two inches long. Above them the skin was freely movable and by their inferior surface they were free. No redness of the skin was seen at this time.

I had the opportunity of examining the progress of this case very carefully for a month after the February consultation. The patient was weak; debilitated, and rendered almost hysterically nervous from the suffering during the day by the flushing and lancinating pains and from these combined with headache at night. The tumors were exquisitely painful and the slightest touch was dreaded. It was only after the fourth day, during which time the patient had taken bromide of potassium and codeia, that I could make a thorough examination of the tumors, and I found from the surface thermometer a temperature of $98\frac{3}{4}^\circ$ F. on the tumors. During this period of illness she had lost much flesh. As soon as the pain had been relieved, the codeia was stopped and the bromide, combined with the iodide of potassium, was given in doses, beginning with thirty grains of the bromide and ten of the iodide, three times daily. Besides this, forty grains of mercurial ointment were rubbed into the groins, armpits, and legs near the tumors daily for about ten days. The iodide was pushed to forty grains, thrice daily.

The further history of the tumors is interesting and peculiar. The rosy red deepened into a sombre red, and then in the centre of each, which was slightly convex, the redness gradually paled until a color similar to white wax was left. The tumors then presented a very striking appearance: about one-third of their whole extent and sharply limited to their centres, they were of this waxy color, which was surrounded by an areola of various shades, constituting a peculiar play of colors, such as is often seen in erythema nodosum, and which is admirably shown in plate No. 3 of the late Tilbury Fox's *Atlas of Skin Diseases.* The differences, though, if carefully studied, were well marked. There was a more aphlegmasic, indolent, and subacute appearance to the eruption of the patient. The various shades of circumferential redness were more sombre, the tumors which then could be examined were more sharply circumscribed, and there was decidedly less surface heat than in simple erythema nodosum. Yet I can readily see how an error could have been made.

In proportion as the bromide and iodide were pushed and the mercurial inunctions continued, the nutrition of the patient improved, the appetite returned, the headache ceased, and the neuralgic pains grew less, so that on the twentieth day after the institution of the treatment the condition of the patient was very favorable. The tumors slowly underwent absorption. The waxy colored centre increased peripherally as the variegated and sombre red areola grew less, until in a month the site of the tumors showed only traces of slight hyperæmia. But for fully three weeks after the disappearance of the surface changes distinct nodules, non-adherent to the skin above and the fasciæ beneath, could be distinctly felt. The subcutaneous tumors on the thighs were aborted by the treatment. At first the pain grew less and soon their size diminished, until in about a month they could be no longer felt.

The date of invasion of this eruption was four months after infection.

In the spring and summer of the year 1879, while attending physician to the class of skin diseases at Bellevue Hospital, I had under my care a woman whose case was to me and to my colleague, the late Professor Bumstead, unusual and remarkable.

Case VII.—The patient was a married woman, twenty-five years of age, of dark complexion, very thin and sallow, who had long lived in the South and suffered from malaria, chiefly in the form of remittent fever and neuralgic pains in the head. She had been infected with syphilis in April and had active and extensive papulo-pustular eruption, double iritis, and nodes on the cranium and on both ulnæ, near the elbow-joint. For these she was treated and was in August free from lesions, when she began to complain of an atrocious nocturnal cephalalgia. This was followed by pain in the larger joints and a marked hyperæsthesia in both legs. Coincidently there were malaise, loss of appetite, insomnia, and, as she tersely described it, a generally wretched condition. After three days of this suffering she observed some red patches or swellings on the legs, chiefly on the middle and upper thirds. I saw her two days after the invasion of this eruption and found her scarcely able to walk. Both legs were swollen, red, and œdematous. On each were fully six large plaques of infiltrated skin. The color was of a deep red, the epidermis tense and shining, and slightly elevated above the intervening skin, which was also œdematous and less red than the tumors. There were two large oval tumors on the outer surface of the thighs. These lesions were hard and firm to the touch and so exquisitely sensitive that it was with much difficulty that an examination could be made. The infiltrations increased in extent, became more salient, while the deep red color became of a bluish-black, exactly like a severe contusion. The intensity of the discoloration was greatest in the centre and shading off slightly toward the periphery. About fourteen days elapsed between the onset of the skin lesions and their full development. At that time the severe neuralgic and rheumatoid symptoms were much relieved and the general condition of the patient better. I was at that time disposed to attribute the relief of the neurotic condition to the large doses of bromide which were given, but subsequent observation has shown me that in some cases in proportion as the eruption matures the suffering grows less. Mauriac has also observed this fact. A point of interest in this case was that several of the tumors so increased in size that they fused together and resulted in patches of infiltration nearly six inches in diameter. Under the mixed treatment and soothing applications resolution took place slowly, except in two of the tumors seated on the lower third of each leg, which softened in the centre, ulcerated, and presented the characteristics of ulcerating gummata.

The period of evolution of this eruption was about fourteen days, the subsequent stationary period was a month for the resolutive tumors and about two months for the ulcerative ones. The date of evolution of the eruption was four and a half months. Very little scarring was observable on the sites of the ulcers.

Case VIII. was that of a gentleman thirty-two years old, who was under my care in the summer of 1885. He contracted syphilis while abroad and had a small ephemeral initial lesion, followed by very mild secondary manifestations. In the fifth month of his syphilis he became much worried by business reverses and was forced to undergo severe physical and mental strain. In this condition, being a thin, not very strong person, he began to suffer from nocturnal cephalalgia, intermittent neuralgia of several of the left intercostal and of both anterior crural nerves. About a week after the onset of this neuralgic condition he noticed on each leg a number of bright red swellings. These increased in size and followed precisely the same course as was observed in the first cases. I found the same hyperæsthetic tumors, with a waxy looking centre and the variegated areola. Rather less than fourteen days elapsed from the time of invasion to the full development of the eruption. He was cured by local inunctions and iodide of potassium internally.

Case IX. was that of a woman forty-eight years of age, who was of robust build, but had suffered at intervals during the last ten years with rheumatism. She was much given to alcoholic excess. Ten weeks after infection, which was in December, 1882, coincidently with a copious roseola, she was attacked by an eruption of round and oval tumors on the forearms, legs, and hypogastrium. The deep red color became deeper until a hemorrhagic appearance was presented. Then paling begun in the centre, being first of a bluish-green, then dark green, then of a brownish-yellow, until entire resolution was effected in two months.

Case X. was also that of a woman fifty-three years of age, seen by me in the fall of 1884. She had borne twelve children in fifteen years and thought that the ill health from which she had suffered since she was forty years of age was the result of these frequent pregnancies. She suffered also from subacute bronchitis which had followed pneumonia. Three months after infection she had a copious eruption of the tumors such as I have already described, which were the seat of neuralgia and surrounded by hyperæsthetic skin. Resolution did not take place, the tumors softened and broke down into typical gummatous ulcers, which were healed in three months, during which time a small crop of new tumors developed. Very superficial scars were left.

These five cases, I think, may be taken as typical illustrations of the third form of precocious gummata. The date of evolution of the eruption was respectively four, four and a half, two and a half, and three months after infection, while in Mauriac's cases the eruption began at two months in three cases, four and a half in one, and at nine months in the fifth. In my cases it occurred in women four times and in men once, while in Mauriac's cases three times in men and twice in women. In my cases the ages of the patients were thirty-seven, twenty-five, thirty-two, forty-eight, and fifty-three, while those of Mauriac were thirty-eight, forty-seven, twenty-three, and thirty-four. So that in no case has it thus far been found earlier than the twenty-third year, nor later than the fifty-third.

The clinical history of this form of syphilide has an individuality of its own. In the very early months of the diathesis, either in the stationary period of an early syphilide or at its decline, generally preceded or accompanied by severe neuralgic symptoms involving the facial or cranial, intercostal, anterior crural or, in fact, in any cutaneous nerve, by severe cephalalgia, continuous or nocturnal; by rheumatoid pains in muscles or joints, and by general malaise and debility, this eruption makes its appearance with more or less promptitude and develops quite rapidly. In some instances the invasion is very acute, so that at the end of a week we may find fully developed tumors an inch or two long, in others and in the majority of instances the development is slower and nearly two weeks elapse. Besides the general neuralgic symptoms, local pains on the site of the lesions or in the whole territory on which they are developed are experienced. These may be continuous or intermittent and in some cases are as excruciating as in severe herpes zoster. They are described as flashing, burning, lancinating, and are sometimes said to resemble those of an abscess. In some instances the sufferings are less after the evolution of the syphilide, but in the majority of the cases the tumors throughout their course are the seat of exceeding hyperæsthesia and patients shrink with terror from their palpation. Besides these phenomena we generally find a moderate febrile movement, an evening temperature of 100° or 101° F., and in the very severe cases as high as 104°; emaciation, want of appetite, and all their concomitant symptoms. The seats of predilection are the forearms and legs, but the tumors are also found on the shoulders, arms, thighs, chest, and trunk. As a result of the pain, swelling, and tension, there are more or less discomfort, stiffness, impairment of motion, even to the extent of a pseudo-paralysis in the arms and legs.

The eruption consists of two orders of lesions: first, tumors or nodosities seated in the subcutaneous tissue and freely movable under the skin and over the fasciæ, though as they increase they may contract adhesions on both surfaces; second, oval or round tumors, or irregular plaques from fusion of tumors. In my experience the subcutaneous nodosities occur much less frequently than the tumors, while Mauriac seems to regard them as almost constant accompaniments to the eruption. The tumors begin by infiltration in the deeper portions of the skin and its contiguous connective tissue. When first seen they are of a bright red, rather sharply circumscribed, and painful. They quite rapidly increase in size into round or oval swellings, slightly raised and convex. In some cases the bright red rapidly becomes darkened until a blackish-red or decidedly ecchymotic appearance is seen, while in others it is of a very deep red, similar to what we see in erythema nodosum. In some cases again the red centre pales and becomes the color of white wax or of a billiard ball, while the deep red border remains in various stages of intensity, consisting of a commingling or play of colors such as we see following a bruise or erythema nodosum. In most of the cases resolution takes place, and there are but two stages: the first, that of condensation; the second, that in which softening takes place, which may, but does not invariably end in resolution. Mauriac is very positive in his assertion that resolution always takes place. In two of my cases ulceration followed softening, and in a case of Dr. Bronson's I observed this same result.

In my Case VII., observed in 1879, ulceration took place and its occurrence convinced my late colleague, Dr. Bumstead, who watched the case with me, that the eruption which had so puzzled us, in which we leaned to the opinion at first that it was a case of intercurrent erythema nodosum, was really a precocious and then anomalous form of gummata. The ulcerations which follow the breaking down of these tumors present all of the characters of the late gummata, only in a more superficial degree. Their edges are usually not quite as thick nor are their floors as deep, but otherwise the appearances are the same and their subsequent course is usually aphlegmasic and chronic. In exceptional cases general inflammation and swelling attacks a limb or limbs the seat of these tumors, and the suffering is thereby intensified. The tumors are usually symmetrically distributed and remain isolated with little tendency to coalescence. In some cases after being fully formed they may take on renewed action, enlarge, and become fused together.

I was much surprised at the cicatrices following the tumors which underwent degeneration. The extent and depth of the process led me to think that much loss of tissue would result, such as we find in late gummata. But, on the contrary, the resulting cicatrices were comparatively slight and it was evident that great destruction of the skin had not occurred.

In all cases of precocious gummata, the use of iodide of potassium is indicated, either combined with a mercurial or with the use of inunctions of mercurial ointment.

Such, then, is a quite comprehensive description of an eruption which Mauriac, who is the only author who has previously described it, has called syphilitic erythema nodosum. I am utterly opposed to the names of skin diseases, such as lichen, eczema, psoriasis, lupus, etc., with the adjective syphilitic being used to signify eruptions due to the diathesis, since nothing but confusion and inaccuracy can result from such a nomenclature. There is every reason against and none in favor of calling this eruption by Mauriac's title. It is a precocious gumma presenting certain resemblances in its mode of invasion, course, and appearances to the erythema nodosum. The clinical history of the simple eruption is different from that of the specific. In the latter there is the history of recent infection, and usually a coexistence of declining or active syphilitic manifestation. The febrile symptoms of the early gummata are usually not as pronounced as those accompanying the simple eruption, nor is its invasion quite as sudden and rapid as in erythema nodosum, it is more aphlegmasic. In the syphilitic eruption the nervous symptoms are usually much more severe than in the simple form. Should doubt exist in the mind of the observer early in the history of the eruption, as the evolution progresses, and with the history of the case before him, with its more chronic and aphlegmasic course, and its rebelliousness to simple treatment, it will soon be dispelled. The fact that these tumors break down and take on the appearances and run the course of typical gummata, to my mind, proves beyond doubt their syphilitic origin and nature.

The coincidence of erythema multiforme with syphilis has been observed by Danielssen,[1] Lipp,[2] and Finger,[3] and has been the subject of a recent paper by Bronson,[4] and beyond the fact that in such cases syphilis usually runs a severe course, as I myself have observed, little which is definite or practical has been evolved. The consensus of opinion concerning this coincidence seems to be that these symptoms are the result of angio-neuritic disturbances, and though due to some occult influence of the syphilitic diathesis, are not pathognomonic of the disease. Bronson goes still further in holding that, though they may begin as simple eruptions, they may later on assume a true syphilitic nature.

I am firmly of the opinion, for reasons already given, that the precocious neurotic gummata are purely of syphilitic origin and nature, and not in any sense intercurrent simple eruptions. As in the palate, throat, iris, and periosteum there is often precocious gummatous infiltration, so in the subcutaneous connective tissue of the skin, which is essentially the one upon which the activity of syphilis is spent, may this precocious development take place. In syphilis, as in sarcoma and leprosy, while in general its new growths are slow, aphlegmasic, localized and chronic, in exceptional cases they may be precocious, generalized, and very active.

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BACTERIOLOGY.

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(FIFTH PAPER.)

II. Study of Bacteria by Means of Cultivation.

The two chief aims in carrying on cultivations of a definite species of bacterium are in the first place to get it pure, and in the second place to keep it pure. The methods of getting a pure cultivation and also the methods of keeping it pure, differ under different circumstances, and, therefore, will be best described as occasion arises; but there are certain points in connection with the second aim which are common to all cultivations. As dust is everywhere, both floating in the air and settled on surrounding objects, and as dust contains large numbers of bacteria or their spores, it follows that all vessels and materials employed in the cultivation and preservation of bacteria are already contaminated. Hence the problem of keeping a cultivation pure resolves itself into two parts—(*a*) the destruction of the microörganisms primarily existing in the vessels and cultivating materials, and (*b*) the prevention of access of new ones. The first thing that must be done then, in connection with cultivations, is to disinfect or sterilize all the vessels employed, and to do this in such a manner that they cannot become reinfected before use. This is done, for the most part, by heat. It has been found, experimentally, that dry heat at the temperature of from 140° to 150° C., continued for two to three hours, effectually destroys all bacteria and spores. Hence all tubes, flasks, and glass vessels in general which will afterward contain cultivating materials, are kept at this temperature for three hours, and, as in the case of tubes or flasks dust might enter during cooling or afterward, their orifices are plugged firmly beforehand with cotton-wool. It is best to use absorbent wool, because the ordinary wool becomes brown and more brittle than the other. Various kinds of apparatus are used for heating the vessels, of which one is shown in the accompanying sketch (Fig. 1). It consists of a double walled vessel, the outer wall being open at the bottom and there being also a hole at

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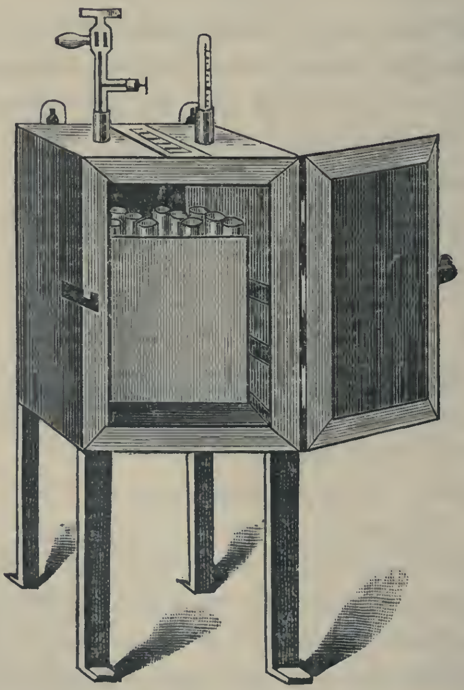
[1] Norsk Magaz. f. Laegervidsk, iv. 6. Two notes by Finger.

[2] Archiv für Dermatologie und Syphilis, 1871, vol. iv. page 221.

[3] Ueber den Zusammenhang der multiformen Erytheme mit dem Syphilis-Processe. Prager med. Wochenschrift, 1882, p. 262.

[4] Erythanthema Syphiliticum. Medical Record, September 4, 1886.

FIG. 1.



Hot box containing a crate with tubes, and fitted with a thermometer and thermo-regulator.

the top. The door is also double. The gas-flame plays over the open part at the bottom and a current of warm air circulates between the walls so that the interior is equally heated. At the top a thermometer is passed through a hole in both walls into the interior and there is also a place for a thermo-regulator. The form of apparatus shown in the sketch may either stand on the floor or be hung up on the wall—a layer of asbestos paper intervening between it and the wall. It is more convenient than the older forms, where there was no door outside, but where the inside box was enclosed in an outer iron cover. Here the door can be opened and apparatus removed or introduced with great ease and without first allowing the box to cool.

All the other apparatus which comes in contact with the cultivating material, such as inoculating needles, pipettes, etc., should also be sterilized by dry heat. Antiseptic lotions, especially 1:1000 corrosive sublimate solution in water, may be used to purify the outside dishes, etc., in some cases, but they must not be employed for anything which will come in contact with the cultivating material, because a very small quantity of the sublimate will prevent growth. Carbolic acid must also be avoided unless it is afterward washed away, as even the presence of the vapor will hinder development.

There are two classes of cultivating materials employed, viz., fluids and solids. The methods by which these are prepared and used differ a great deal, and must therefore be considered separately.

1. Fluid Cultivating Media.—A great many fluid media have been employed, of which I need only indicate the chief ones. That most frequently used at the present time is an infusion of meat. This may be prepared by cutting up a pound of lean beef into small pieces and placing it in a vessel containing a litre of water. This is set in an ice safe for twenty-four hours, and then by means of a press all the juice is squeezed out of the meat. Where an ice safe and press are not at hand, it is sufficient to keep the material simmering for two or three hours. In either case, the resulting fluid is boiled well so as to precipitate the albumen. It is then filtered and may be at once introduced into suitable vessels. In this condition the meat is acid, but as an acid medium is not a good soil for many forms of bacteria, it is often neutralized with carbonate of soda. This should be done before it is boiled. The infusion can be made still more serviceable by adding about one per cent. of peptone and a little common salt to it. Some prefer for different purposes the flesh of other animals, such as calf, sheep, chicken, etc., but there is not really much advantage in the one infusion over the other.

Various vegetable infusions are also very serviceable. At one time I used an infusion of cucumber very extensively, and found it an excellent material, more especially for micrococci. It is, however, strongly acid, and must be neutralized when required for many forms of bacilli.

Urine was at one time a very favorite medium, but it has fallen into disuse of late. It may be used unboiled or boiled. Urine, as it exists in the bladder of a healthy person, is free from microörganisms, and the problem is therefore to get it into sterilized vessels without contamination. This may be done in the following manner: The glans penis is first thoroughly washed with 5 per cent. carbolic acid solution, and then with 1 : 500 corrosive sublimate solution. Not only is the glans washed, but the lips of the urethra are everted and also washed. The first few drops passed are rejected, as they may be mixed with the disinfecting solutions. The cotton-wool cap of a sterilized flask being removed, its place is instantly taken by the glans penis, and urine is passed into the flask. The cap, which has been held in such a way that the inner surface could not become infected with dust, is then at once reapplied, and the vessel is placed in an incubator, kept at the temperature of the human body, in order to see if it remains pure. For some reason which has not yet been worked out, unboiled urine is not a very favorable cultivating medium; boiled urine, on the other hand, is much better. Hence, as a rule, when urine is employed it is boiled, filtered, and then sterilized by heat.

Cow's milk is also a very excellent cultivating fluid. As the milk exists in the gland of a healthy cow, it is free from bacteria and with suitable precautions can be obtained pure, but the difficulties are great, and boiled milk is quite as good a cultivating material. Fresh milk should be employed, and must be sterilized by heat.

Blood and blood serum are also sometimes employed. The blood is withdrawn with precautions against contamination. The skin is thoroughly scrubbed with antiseptic lotions (carbolic acid and corrosive sublimate), and is then divided with a disinfected knife—in fact, the various steps of the operation are performed antiseptically; when the vein is exposed (the internal jugular vein is the best) a ligature is placed loosely around it, a small incision is made, and a piece of glass tubing, sterilized by passing it through the flame, is tied in. To the end of the glass a piece of India-rubber tubing, which has been boiled, is attached, and the end of this is passed into a sterilized flask, a mass of pure cotton-wool surrounding it at the neck of the flask. When sufficient blood has been obtained the tube is clamped and withdrawn from the flask, and the proper sterile cotton-wool plug is applied. It is often difficult in such a case to get a supply of serum. Sir Joseph Lister observed that when the flasks were sterilized by heat the clot did not contract even after many weeks, and no serum could be obtained. In order to prevent this occurrence it is necessary to agitate the contents of the flask for some time, in the same manner as one whips blood. Blood or serum obtained in this way is, contrary to expectation, a very bad cultivating medium; very often it is necessary to introduce a large number of the bacteria before growth can be obtained. On the other hand, if the serum or blood is diluted with water, growth occurs readily and luxuriantly.

The simplest way of obtaining serum is to withdraw it from the body without taking all the precautions mentioned before, only taking care not to let in more microörganisms than is unavoidable and then, when the serum has separated, to collect it in sterilized tubes and sterilize it by repeated heating to a temperature short of coagulation (about 60° C.) for an hour a day for five or six days in succession.

At one time artificial cultivating materials were a good deal employed, of which the chief were Pasteur's and Cohn's solutions. These have now fallen into disuse because they are by no means favorable cultivating media, only a few species of bacteria growing in them at all readily.

The composition of Pasteur's solution was:

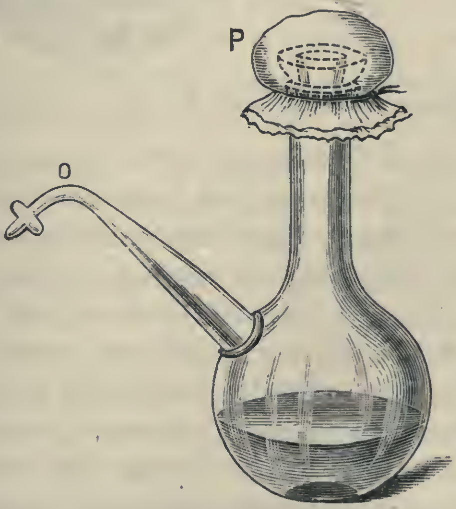
Tartrate of ammonia	1 gramme.
Candy sugar	10 grammes.
Ashes of yeast	1 gramme.
Water	100 c. cm.

Cohn introduced the following modification of Mayer's solution:

Phosphate of potash	0.5	gramme.
Crystallized sulphate of magnesia	0.5	“
Tribasic phosphate of lime	0.05	“
Tartrate of ammonia	1	“
Distilled water	100	c. cm.

In using these fluid cultivations it is often convenient to keep a stock solution at hand. For this purpose the flasks introduced by Sir Joseph Lister are very convenient (Fig. 2). These flasks have two necks, a large vertical one and a lateral one, which is a bent spout, large at its commencement and comparatively narrow at its shorter terminal part beyond the bend, O. The large size of the first part of the neck prevents it acting as a siphon, and the result is that when liquid is

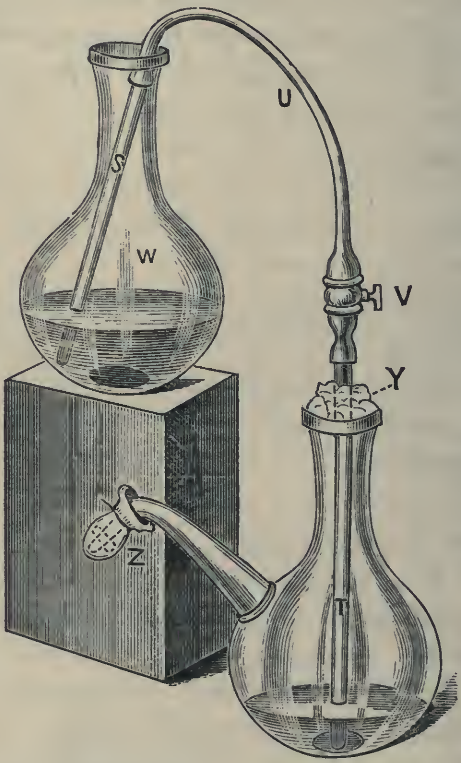
FIG. 2.



Lister's flask for preserving cultivating materials. O, the narrow neck. P, the cotton-wool cap.

poured from such a flask, and the vessel is afterward restored to the erect position, the end of the nozzle remains filled with a drop of the liquid, and this guards the orifice so that regurgitation of air can never take place through the nozzle. Before sterilizing these flasks a cap of cotton-wool is tied over each orifice so as to prevent the entrance of dust. In filling these flasks (Fig. 3) it is best to introduce the fluid into them by means of a siphon (U), consisting of two glass tubes connected by two pieces of India-rubber tubing with an intervening stop-cock (V). The siphon is first completely filled with water, and then one leg (S) is placed in the vessel containing the filtered cultivating material (W), and the tap is turned so as to run off the water and replace it with this fluid. The stop-cock is then shut, a piece of carbolized rag is wrapped around the lower extremity of the free tube and applied to the mouth of the flask as soon as the cotton cap is removed; the tube (T) is then pushed steadily down to the bottom of the flask (X), through the carbolized rag (Y), the stop-cock turned, and the required amount of fluid introduced. When this has been done the tap is again turned off, the siphon withdrawn through the antiseptic rag, and a fresh cap of sterilized cotton-wool is tied over the mouth of the flask when the carbolized rag is removed. The fluid is then sterilized and can be kept for any length of time. A portion of the fluid can be poured out of the flask

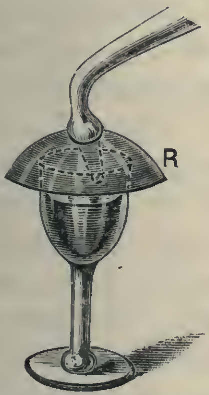
FIG. 3.



Method of filling a Lister's flask (see description).

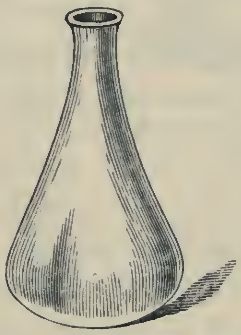
into smaller vessels from time to time without injury to the stock solution. To do this the cotton cap is removed from the nozzle of the flask, and the end of this is instantly slipped through an opening in the centre of half an India-rubber ball which has been previously sterilized (Fig. 4, R). The protecting plug or cap having been removed from the vessel to be filled, the India-rubber cap instantly takes its place, thus preventing all entrance of dust, and the requisite amount of fluid is poured into it. When this is done, the sterile plug is again inserted into the newly filled vessel. The India-rubber ball is then removed from the flask, the drop of fluid which remains in the nozzle sucked away with a carbolized rag, and a fresh sterilized cotton cap is applied. With a little practice these manipulations can be carried out in such a way that neither the fluid in the stock solution nor that in the newly filled vessel is contaminated; but it is well to make quite sure of this by sterilizing both again. If it is necessary to know exactly the quantity of fluid in the flask or tube, it must be filled by means of a graduated pipette or burette.

FIG. 4.



Method of filling vessels from a Lister's flask. R, half an India-rubber ball through which the nozzle is passed.

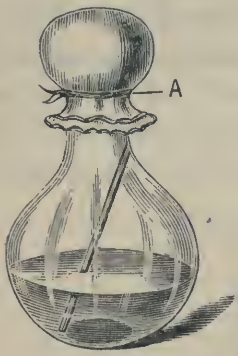
FIG. 5.



Erlenmeyer's flask.

For cultivating purposes the vessels generally used are test tubes or flasks, the form known as the Erlenmeyer flask (Fig. 5) being the best. The necks of the tubes and flasks are generally tightly plugged with cotton-wool before they are sterilized in the hot box. The objections which I have to this method are that dust collects on the top of the wool and in pulling out the plugs some particles may fall into the interior. The danger of contamination can generally be avoided by igniting the top of the plug before it is removed, thus destroying any living germs which may be present in it. But particles of dust may have passed down for some distance between the wool and the glass, and may escape destruction. This is not of so much moment where the cultivations are solid, because the vessels may be held very obliquely or even upside down, but where fluids are used it is not so easy to prevent their admission. For this reason, when I use fluids I generally employ flasks and not test tubes, and instead of plugging their necks I tie the wool over the orifice, and, as after sterilization the wool is more powdery, I enclose the mass of wool in a double piece of gauze (Fig. 6, A). The mass is bent over the mouth of the flask and secured round the neck by copper wire. Before opening the flask I wet the edge of the wool all round with carbolic lotion and also moisten its whole surface. Thus, even though the carbolic acid may not have destroyed the spores on the wool, the moisture fixes them so that they do not fly about when the wool is lifted. Another advantage of this arrangement is that the wool need not be completely removed from the orifice of the flask, but one side may be lifted and any instrument slipped into the flask under cover of the cap.

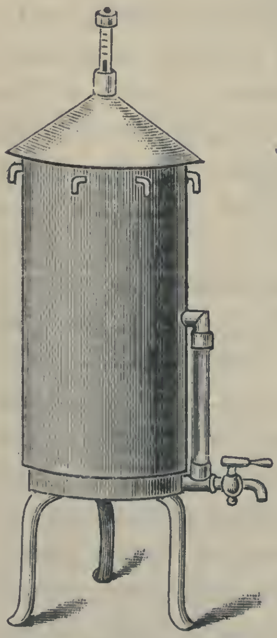
FIG. 6.



Flask with cotton-wool cap containing cultivating fluid inoculated by means of a capillary tube.

The culture fluids having been thus prepared, filtered, and introduced either into the stock flask, or into the smaller flasks, must be sterilized because, during filtration and the other manipulations, they have become contaminated from the air and surrounding objects. This sterilization is best effected by means of Koch's steaming apparatus (Fig. 7). This is a deep iron or tin vessel in the bottom of which water is placed, and just above the water is a tray on which flasks, etc., can stand. The lid fits loosely and both the lid and the vessel itself are surrounded with felt. The water in the interior is boiled till steam issues from the top, and till the thermometer passed through the lid indicates almost 100° C. The vessels containing the culture fluid are then introduced and allowed to remain for from half an hour to an hour. The result is that all bacteria not in the spore state are killed. Following Tyndall's experiments the flasks are then set aside in a moderately warm place for twenty-four hours. By that time spores, if present, will probably have sprouted and, therefore, the steaming process is repeated. To make the sterilization quite certain, another twenty-four hours are allowed to elapse and again the flasks are heated. The result of this is that one may reckon with certainty that all bacteria present in the fluid are destroyed. This is a much better way of proceeding than the old plan of boiling the fluid, because in boiling the fluid a large amount of evaporation occurs, and its constitution is, therefore, altered, and also if any portions of the original impure fluid have remained at the top of

FIG. 7.



Koch's steaming apparatus for sterilizing culture materials.

the flask, or been splashed up during the bubbling, they may not be sufficiently heated and may afterward contaminate the mass. On the other hand, in the steaming apparatus the whole flask is equally heated and sterilized. Indeed, with such fluids as milk this is the only possible way of sterilizing them, because on attempting to boil milk a scum forms on the surface and the milk either boils over or is imperfectly sterilized.

In the case of blood serum, as has already been said, the temperature should not be raised above 60° C., for coagulation occurs at 65° C. It has been found, however, that an hour's exposure to 60° C. is sufficient to kill almost all adult bacteria, and one may reckon that if this process is repeated for, say, five or six days in succession, the serum will be completely sterilized.

After the process of sterilization is complete the vessels should be placed for three or four days before use in an incubator kept at the temperature of the human body, in order to be certain that the material is thoroughly sterile.

These flasks may be inoculated in various ways, but more care is requisite than in the case of solid cultures, and a number of flasks must be inoculated at the same time in order to guard against error. The same method may be employed as in the case of cultures on solid media, viz., a piece of thin platinum wire is fixed in the end of a glass rod—a thing easily done by heating both in a Bunsen flame and then pushing the wire into the soft glass—and this wire being heated and allowed to cool is dipped in the material to be tested and then introduced into the fluid under cover of the cotton-wool cap. This can be rapidly done, as a mere touch is sufficient to infect the fluid.

In my early experiments with discharges from wounds[1] I employed the following plan with complete success. Small capillary tubes, those used for vaccination for example, are passed through the flame several times to sterilize them. The end is then applied to the wound and at once a small quantity of the discharge runs up into the tube. The edge of the cotton-wool cap being now lifted, the tube is then dropped into the flask and the cap reapplied (see Fig. 6).

Another plan which I employed when inoculating a second flask from the first, was to use a piece of glass tubing bent at right angles and attached by means of a small bit of India-rubber tubing to a small brass syringe, the piston of which had a ring at the end. The cap of the first flask being slightly raised at one side, the tube, previously heated in the flame and allowed to cool, was introduced into the flask, a small quantity sucked up by withdrawing the piston slightly by means of the little finger passed through the loop and then the cap of the second flask being lifted a drop was expelled into it. With a little practice this manipulation can be performed rapidly and safely. By the same manœuvre small quantities can be withdrawn for microscopical examination as before described.

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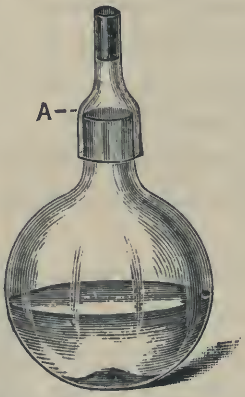
[1] Antiseptic Surgery, p. 230.

The above methods are what I have found quite sufficient to enable me to carry on cultivations in fluids with great ease and certainty, but numerous other plans have been described. Pasteur employs a number of peculiar shaped flasks for the preservation of fluids, but as these have no advantage over the Lister flasks, and are more complicated, I need not mention them. The flasks which he uses for cultivations are, however, very simple (Fig. 8). The outside of the necks of these flasks is ground, and over this a glass cap (A), ground inside, fits tightly, and the upper part of this cap, which is narrowed, is plugged with wool, asbestos, etc. The cap is lifted for purposes of inoculation, examination, etc.

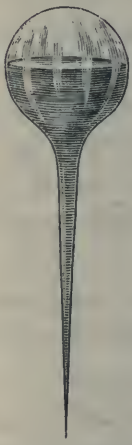
Sternberg describes his method as follows:[1] "The culture flasks employed contain from one to four fluid-drachms. They are made from glass tubing three- or four-tenths inch diameter, and those which the writer has used in his numerous experiments have all been home-made. It is easier to make new flasks than to clean old ones, and they are thrown away after being once used. Bellows, operated by the foot, and a flame of considerable size—gas is preferable—will be required by one who proposes to construct these little flasks for himself. After a little practice, they are rapidly made; but as a large number are required, the time and labor expended on their preparation is no light matter. After blowing a bulb at the extremity of a long glass tube of the diameter mentioned, this is provided with a slender neck, drawn out in the flame, and the end of this is hermetically sealed (Fig. 9). Thus

FIG. 8.



Pasteur's cultivating flasks. A, glass cap. (After Hueppe.)

FIG. 9.



Sternberg's bulb containing culture fluid, and ready for use.

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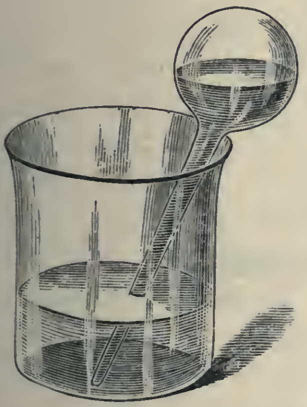
[1] Magnin and Sternberg: Bacteria, p. 176. Wood & Co., New York, 1884.

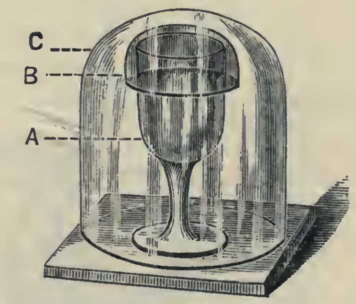
one little flask after another is made from the same piece of tubing, until this becomes too short for further use. To introduce a culture liquid into one of the little flasks, heat the bulb slightly, break off the sealed extremity of the tube, and plunge it beneath the surface of the liquid (Fig. 10). The quantity which enters will, of course, depend upon the heat employed, and the consequent rarefaction of the enclosed air. Ordinarily the bulb is filled to about one-third of its capacity with the culture-liquid, leaving it two-thirds full of air for the use of the microscopic plants which are to be cultivated in it." These fluids are then sterilized by the usual methods, and the flasks are kept in an incubator for several days, to make sure that they are pure. "To inoculate the liquid contained in one of these little flasks with organisms from any source, the end of the tube is first heated to destroy germs attached to the exterior; the extremity is then broken off with sterilized—by heat—forceps; the bulb is very gently warmed, so as to force out a little air, and the open extremity is plunged into the liquid containing the organism to be cultivated. The smallest quantity of this is sufficient, and as soon as the inoculation is effected, the end of the tube is again sealed in the flame of an alcohol lamp. A little experience will enable the operator to inoculate one tube from another; to introduce a minute quantity of blood containing organisms directly from the veins of a living animal; to withdraw a small quantity of fluid from the flask for microscopical examination, etc., without any danger of contamination by atmospheric germs."

FIG. 10.



Method of filling Sternberg's bulbs with culture fluid.

FIG. 11.



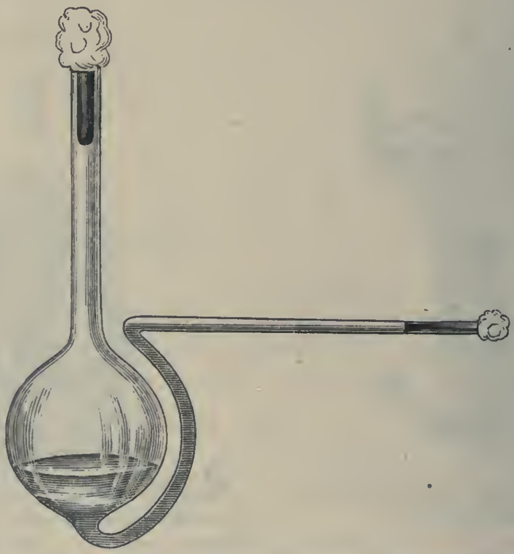
Apparatus employed by Sir Joseph Lister in his experiments on lactic fermentation. A, liqueur glass. B, small glass cap. C, large glass shade covering the whole.

Sir Joseph Lister, in his experiments on lactic fermentation, employed a liqueur glass (Fig. 11, A) covered by a glass cap (B), both being covered by a glass shade (C), the glass and the shade standing on a glass plate.

The shade is removed, and the glass cap being lifted for a moment, the contents of the glass can be readily inoculated.

Fluid cultivation materials possess advantages in special cases, though for most purposes they have now given place to solids. One advantage which they have over certain solids is that they can always be placed in an incubator at the temperature of the human body without the result being in any way spoilt, whereas with certain solid media, such as gelatinized media, this cannot be done. In experiments on the growth of bacteria in different gases, fluid media are especially useful, and it is by no means easy with solids to insure that all the air is displaced by the gas to be tested. In my report on micrococci in relation to wounds, abscesses, and septic processes,[1] I described a very simple and efficient plan which I had devised for this purpose. Into the bottom of a glass bulb capable of containing about one ounce of fluid, and having a neck six inches long and about half an inch in diameter, is sealed the end of a long, narrow tube, which is bent up round the side to the top of the bulb, and then runs out for about four inches in a horizontal direction. The end of this tube is well plugged with cotton-wool, a cotton-wool cap is tied round the opening of the neck, and the whole apparatus is sterilized in the hot box (Fig. 12). The purified infusion is then introduced with the usual precautions into the bulb, so as to fill about one-third of it, the cap reapplied, and the infusion sterilized again in the steaming apparatus, if necessary. The bulb is then placed in the incubator for some days to make sure that the fluid is sterile. When the experiment is to be performed the cap is lifted, the fluid inoculated with the bacteria in the

FIG. 12.



Bulb for testing the influence of various gases on the growth of bacteria.

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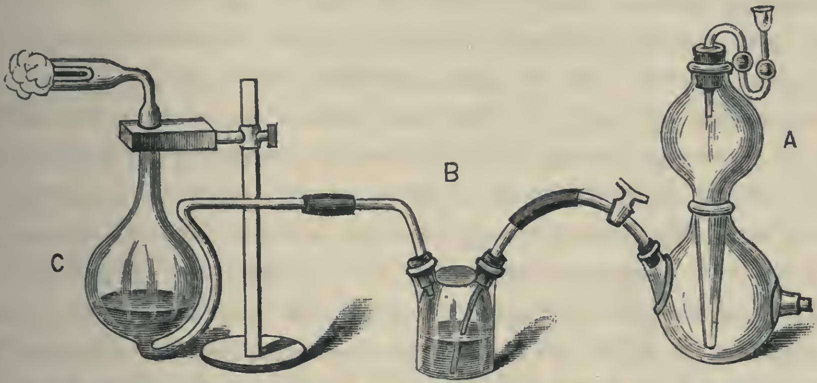
[1] British Medical Journal, September and October 1884.

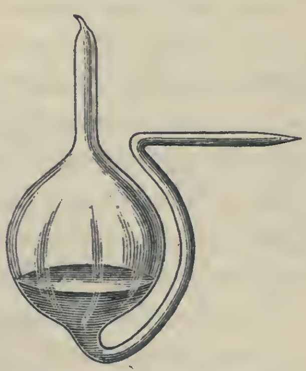
manner formerly described for flasks, the cap reapplied, and the neck bent to a right angle and drawn out fine, so as to be ready for rapid sealing. The end of the other tube is then connected with the apparatus for generating and washing the gas, and the gas is passed through the fluid until the latter is thoroughly impregnated with it, and the air in the bulb has been entirely displaced (Fig. 13). The time required varies with the rapidity of the flow of the gas, but ten minutes are, as a rule, amply sufficient. The flow of gas is now stopped, and the neck and the small tube sealed in the flame of a spirit lamp (Fig. 14). Thus there is only the gas to be tested in contact with the fluid, and no possibility of entrance of other gases from without. The apparatus can now be placed in an incubator.

FIG. 13.



To show the method of passing the gas to be tested through the inoculated bulb. A, the gas generator. B, wash bottle. C, bulb containing the inoculated fluid.

FIG. 14.



Bulb with both ends sealed after the gas has been passed through it.

Another purpose, for which fluid media is employed, is for drop cultures. (See under "Microscopical Examination of Unstained Specimens.") Cupped slides are cleansed and passed through the flame, or heated in the hot box, in a beaker plugged with cotton-wool. At the same time. thin cover-glasses are heated by passing them several times through a gas-flame, and are then laid on a glass plate, and allowed to cool under cover from dust. A small drop of the culture fluid is then placed on the centre of the glass, and inoculated with the material to be studied. A little vaseline is put round the margin of the cell, the slide inverted and pressed down on the cover-glass, so that the drop is opposite the centre of the coil, and the slide then rapidly turned upward. These drop cultures are very convenient for observing the movement and growth of bacteria, and for the latter purpose, and for the study of spore formation and sprouting of spores, I have used them extensively. The sprouting of spores[1] may be readily followed by inoculating a number of these cupped slides with spore-bearing material, and placing them in an incubator. Remove one at stated intervals (say, one hour, one and a half hours, two hours, etc.), lift up the cover-glass, turn it over, and dry the drop of fluid. When dry wipe off the vaseline from the margin of the glass, and stain in a suitable material. In this way, a series of preparations can be obtained, showing all the successive stages in the sprouting of spores. In the same manner, the cycle of growth of an adult organism can also be studied, but, in order to get a series of specimens showing accurately the successive changes, it is necessary to have the same proportion of bacteria to the fluid in each specimen, otherwise a specimen with many bacteria, and but little fluid, may show more advanced changes, especially in the matter of spore-formation, after the same length of time than a specimen with a smaller proportion of bacteria to the fluid. This is easily managed by inoculating a flask of fluid with the bacteria to be studied, placing it for a few hours in an incubator, and shaking it well before taking the drops from it. The bacteria will thus be equally distributed through the fluid, and a fairly accurate series of specimens can be obtained.

As has just been said, fluid cultivations have dropped greatly into disuse of late, on account of very serious disadvantages which they possess, and on account of the many advantages obtained by the employment of solid culture media. The two great disadvantages of fluid media are, that if they become contaminated, the cultivation is spoilt, because the newcomers mix thoroughly with the original bacteria, so that further inoculations from such flasks simply carry over the two kinds. The second disadvantage is, that the original culture must be started from a material containing only one kind of bacterium, for it is extremely difficult with fluid media to separate one form from another. This separation has been attempted in various ways, but these are far too difficult, and require too much time to render them practically useful.

The old plan was, to arrange the composition of the cultivating material, so that it was more suitable for the growth of the desired species than for other species. Then, by fresh inoculations daily, as small a portion as possible of the inoculating material being taken, it was hoped that the desired species would gain the upper hand, and ultimately be obtained pure. This hope was, however, but rarely realized.

The best method was that used by Sir Joseph Lister in his experiments on lactic fermentation, and proposed also independently by Nägeli about the same time. A series of flasks of milk were prepared and sterilized. The milk containing the *Bacterium lactis*, along with other bacteria, was then taken and an attempt made to estimate the number of bacteria in each drop. This was done by placing one-fiftieth of a minim on a cover-glass of such a size that when pressed down on the slide the drop occupied exactly the area of the cover-glass. The number of bacteria in this quantity was next calculated, and then the milk was diluted with boiled water to such an extent that every hundredth of a minim was estimated to contain one bacterium. To each of the glasses containing the pure milk one-one-hundredth of a minim of the diluted fluid was then added and the result was, that in a certain number a pure cultivation of *Bacterium lactis* was obtained.

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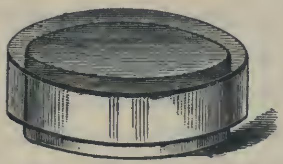
[1] See paper on Bacillus Alvei. Journal of Royal Microscopical Society, August, 1885.

2. SOLID CULTIVATING MEDIA.—If a boiled potato is sliced and exposed to the air, it will be seen in a few days that the surface of the potato is dotted over with spots of various sizes, some colored, some white, some slimy, some dry, etc. These spots are groups or colonies of various microörganisms, and each has developed from one or a clump of individuals which has fallen on it from the air. In the early stage, while these colonies are yet small, most of them are isolated, so that each of them generally represents a pure cultivation of one or other form of microörganism. If now a small portion of one of these colonies is transferred to a fresh potato by means of a heated knife or needle, and the potato kept in a moist chamber and protected from dust, a pure cultivation of the organism is obtained. Should any stray organisms fall on the surface of the potato during the procedure, they develop and form colonies where they fell, and, therefore, do not necessarily vitiate the whole of the original culture, portions of which can be found which are pure and from which fresh cultures can be made. One very great advantage of cultivations on solid media over cultivations in fluids is thus at once evident, viz., that while the entrance of an accidental impurity entirely vitiates a fluid culture, it does not necessarily spoil one on a solid medium. Potato has been used as a culture medium by several investigators (*e. g.* Schroeter), before Koch's time, and Brefeld and Klebs also employed gelatinized materials, but this was with the view of preventing evaporation, and also of enabling one to turn cultures on glass slides upside down so as to prevent dust falling on them. It was Koch who first recognized the value of solid media in enabling the investigator to get and to keep cultures pure, and in his hands the methods have been elaborated and simplified so that they are now universally adopted. In order to obtain a transparent solid culture medium, Koch employs infusions solidified by the addition of gelatine, agar-agar, etc. These gelatinized materials have turned out to possess other great advantages besides those of enabling one to get and to keep a cultivation pure. It is found that the shape and mode of spread of the colonies vary in different kinds of bacteria which may be microscopically similar, that one spreads only on the surface, another only in the interior of the jelly, one renders the gelatine liquid, another leaves it solid, etc. To such an extent are these peculiarities distinctive that in several instances the diag-

nosis between two organisms is made almost entirely by their behavior in jelly cultivations rather than by their microscopical appearance, and in all cases attention must be paid to their behavior on cultivation in various media, and to their other characteristics as well as to the microscopical appearances, before deciding as to the species of bacterium under observation. I shall now describe the mode of preparation and use of the materials most frequently employed.

a. Potato. For potato cultivations ripe potatoes are best, the small new potato not being nearly such a good medium. As the earth on the outside of the potato is full of bacteria and spores, it must be washed off as much as possible and the eyes of the potato cleaned out. The potato is then laid in a 1 to 1000 watery solution of corrosive sublimate for about an hour. Afterward it is washed in water and placed in the steaming apparatus and kept at the temperature of 100° C. for a half to three-quarters of an hour. It is then allowed to cool under cover from dust. In the meantime a couple of glass dishes, one larger than the other so as to form a cover, are washed out with 1:1000 sublimate solution, and a piece of filter paper moistened with the same solution is placed on the bottom of each, so that when the one is inverted over the other there is a moist surface at the upper and lower part of the chamber.[1] This is to keep the air moist so that the surface of the potato does not dry. The potato after being cooked and cooled is cut into two halves in the following manner: A long flat knife is heated in the flame and allowed to cool. The left hand is then dipped into 1:1000 sublimate solution and the potato is taken up with it. With the knife held in the right hand a single sweep is made through the potato, and the cover of the moist chamber being lifted, the two halves are separated and laid down with the cut surfaces uppermost. The cover is then replaced and the potato is ready for inoculation. In some cases, where the potato is to be placed at the body temperature and kept for some time, tall narrow vessels similar to those used by Koch for testing air (Fig. 26), plugged with cotton-wool and sterilized, and large enough to hold half a potato, are employed.

Fig. 15.



A pair of glass dishes forming a moist chamber and used for potato, plate cultivations, etc.

The surface of the potato may be inoculated by the platinum wire before described, or by a thin, flat knife, by means of which the material is rubbed over the surface of the potato. The knife or needle is dipped in the cultivation to be inoculated and drawn rapidly over the surface of the newly prepared potato.

b. Gelatinized materials. Solid and transparent cultivating media can be made by adding from five to ten per cent. of gelatine to any of the fluid media previously mentioned. The material, however, which seems most universally useful is a meat jelly of the following composition :

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[1] Where these glass dishes are not at hand a very excellent substitute is a soup plate with a meat plate inverted over it, each having been washed with the sublimate solution and provided with the moist blotting paper.

Meat, finely chopped	1 pound.
Water	1 litre.

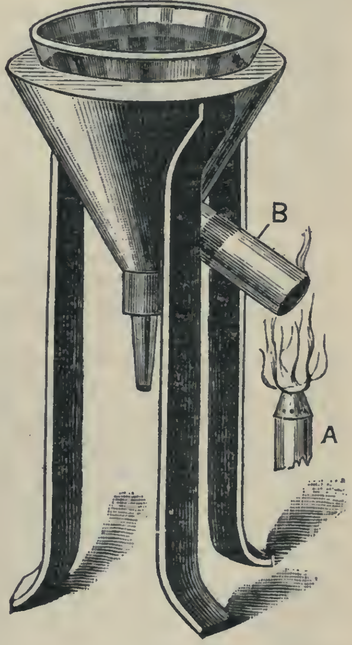
To the meat extract thus obtained add :

Peptone	10 to 30 grammes.
Chloride of sodium	5 "
Gelatine	100 "

Neutralize or render faintly alkaline with carbonate of soda.

The meat and water are allowed to stand in an ice safe for twenty-four hours. At the end of that time the water is strained off and the fluid contained in the meat is obtained by pressing it in a press, this fluid being added to the rest and the whole made up to one quart. This meat extract is now boiled to precipitate the albumen, then the peptone, common salt, and gelatine are added to and dissolved in it, and the whole carefully neutralized by means of carbonate of soda. The mixture is now filtered through a warm water filter, of which the most convenient form is shown in the accompanying diagram (Fig. 16). It consists of a glass funnel fitted into a copper funnel with a space between them in which water lies.

FIG. 16.

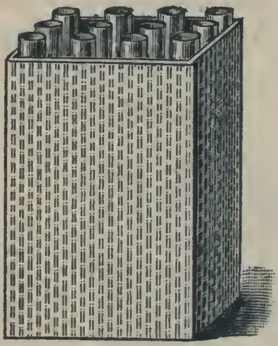


Hot water filter.
A, Bunsen flame playing on the brass arm B.

At the lower part the glass funnel passes through an India-rubber cork which is fixed firmly into the lower opening of the brass funnel, thus rendering the cavity water-tight. In one form a hollow brass arm is attached to one side of the brass funnel and the water in the funnel also passes into this arm. By means of a lamp placed under this arm the water is kept warm. In another form there is no arm, but the filter hangs in a ring which is a hollow tube through which the gas comes, and which has a number of small burners on it. Very often the material must be filtered more than once before it is quite clear. In hot weather, if the filtration occurs slowly, the jelly is apt to be spoilt by decomposition before it is ready. To facilitate matters I have made use of the cook's plan of clearing jellies by means of egg albumen. While the material is cool add to it the whites and shells of two or three eggs, mix well, then place on the fire and boil violently for about fifteen minutes. Care must be taken to remove the pot and scum several times during this process, otherwise the material is apt to boil over. Then strain through flannel. The result is that with the heat the egg albumen coagulates and rises to the surface as a scum, carrying with it all the grosser particles, and leaving the fluid fairly clear. When this has been strained it should be made up again to a quart, filtered and tested to see if it has become at all acid, for if so it must be again neutralized. It will now be found to run through much more quickly. In filtering it, the top of the filter should be covered with a plate or saucer to prevent the upper part of the filter paper from drying up, and the filtrate should be received into a purified vessel.

The jelly, when filtered, is again made up to a quart and may be placed in a pure flask, sterilized, and kept as a stock material, but it is usually put at once into the smaller vessels, in most cases into test-tubes. The test-tubes are washed, plugged with cotton-wool, and sterilized in the hot box as previously described. It is very convenient, for the purpose of handling the tubes, to place them in crates of galvanized iron-wire net (Fig. 17) each holding about twenty or thirty tubes. They are sterilized in this. When filled they are again arranged in the crate, and can be conveniently placed in the steaming apparatus, taken out again, etc.

FIG. 17.



Crate containing test-tubes.

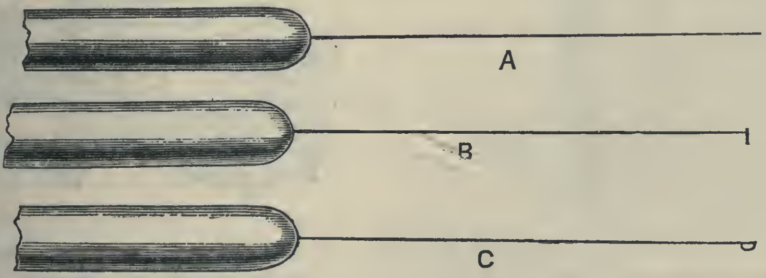
The tubes may be filled in various ways; generally about one-fourth of their interior is occupied by the jelly. In many cases it is important to know how much jelly is present in the tube, and for this purpose the tubes are filled with a sterilized graduated pipette. Generally about 10 c.cm. are put into each tube. The operation is performed in a room but little used, where there is not much dust flying about. The tube is taken between the forefinger and the thumb and held obliquely or even upside down, while the cotton-wool plug is extracted. This is caught by the outer part between the little and ring fingers, the tube is then held more or less upright, the pipette with the jelly rapidly introduced, care being taken to avoid wetting the neck of the tube, the pipette emptied and withdrawn, and the cotton-wool plug reinserted. When it is not absolutely necessary to know the exact quantity it is much more convenient to fill them from a Lister flask in the manner before described.

The jelly must now be sterilized, and this is done by means of the steaming apparatus as before described with fluids. The steamer having been raised to 100° C., the crates or flasks are introduced, and left in it for ten minutes or a quarter of an hour, and this is repeated on three successive days. Care must be taken not to heat the jelly long or too often, for heat converts the gelatine into acid gelatine, which does not solidify. Thus, if the tubes were kept at the temperature of 100° C. for an hour or more for three successive days, the jelly would probably not set at all or only do so very imperfectly. The tubes are now set aside for some days at a moderate temperature (16° to 20° C.) to see if they have been properly sterilized. If the jelly remains quite clear and free from the development of colonies, it may then be used for experimental purposes. When the jelly has been kept in the tubes for some time it evaporates at the upper part, and then when a wire is introduced to inoculate it, it splits. Hence, old jelly should be liquefied and allowed to set again before use.

There are three chief modes of using the jelly for cultivations; these may be termed test-tube cultivations, plate cultivations, and glass slide cultivations. The temperature at which the material should be kept varies from 16° C. to 23° C. or 25° C. Good 10 per cent. gelatine is just solid at 25° C., while very few organisms grow at all well below 16° C. The best temperature for growth and for solidity is from 20° C. to 22° C.

In test-tube cultivations the jelly is allowed to solidify in tubes placed perpendicularly. To inoculate these tubes, the platinum wire fixed in the glass handle is employed (Fig. 18, A). The wire should be quite straight and thin. The cotton-wool plug is set on fire to destroy all the dust on its outer surface. The tube is then held obliquely between the fore and middle finger, the plug withdrawn, and caught by the outer part between the ring and little finger, the wire which, as well as the adjacent piece of glass rod, has been heated and allowed to cool, is dipped in the material to be inoculated and rapidly plunged into the jelly right down to the bottom of the tube. It is then withdrawn, the plug reinserted, and the tube placed upright at a suitable temperature. Where one tube is to be inoculated from another, the new tube is held between the fore and middle fingers well up to the web, and the old tube between the middle and ring fingers near their tips, and the cotton-wool of the new tube is first removed. The idea is that if all the dust in the corks

FIG. 18.

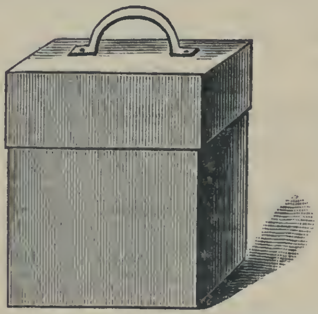


Platinum needles for inoculation. A, straight needle for inoculating tubes. B, bent needle for glass slide cultivations. C, looped needle for plate cultivations. (After Crookshank.)

is not destroyed by the burning, it will not much matter if that from the cork of the new tube falls into the old one; whereas, if the opposite were the case, the new cultivation would be spoilt. The result of this method of inoculation is that growth may occur either along the track of the needle in the interior of the jelly, or on the surface, spreading from the point where the needle entered the jelly, or at both places, and from this and from the characters of the resulting growth, valuable information is often obtained as to the kind of bacterium under observation. In some cases where only a surface growth is wanted, it is most convenient to allow the jelly to solidify obliquely, and then inoculate the surface by drawing the infected needle over it. In keeping up a series of cultivations these test-tube cultivations are always employed.

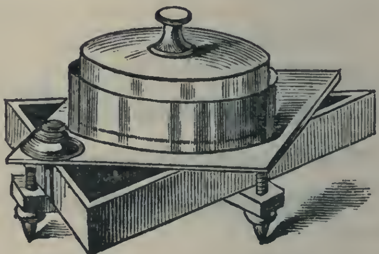
Plate cultivations are of great value for many purposes—*e. g.*, for separating bacteria from one another in a mixture; for studying the characteristics of particular forms; for ascertaining the number present in any material, or whether any are present at all, etc. In this method of cultivation a tube is inoculated with the material to be investigated; the jelly is liquefied at the body temperature; it is then well shaken to diffuse the bacteria throughout it, and before it sets it is poured out on a sterilized glass plate, which is afterward kept at a proper temperature in a moist chamber, protected from dust. The glass plates are flat pieces of glass, generally oblong in shape, and measuring about six inches by four. They are cleaned and placed in an iron box like that shown in Fig. 19. This box containing the plates is sterilized in the hot box in the usual manner. The dishes used for keeping the plate cultivations are similar to those employed for potatoes, and are prepared in the same manner. Several plates may be placed in the same dish by using a series of glass supports placed one above the other. These are easily made by taking a long narrow piece of glass, and fastening to one side of it at each end a thick glass bar by means of Canada balsam. In

FIG. 19.



Iron box in which the glass plates used for plate cultivations are sterilized and kept.

FIG. 20.



Arrangement for providing a level surface for plate cultivations. The plan described in the text for rapid cooling by means of iced water is not shown in this drawing.

pouring out the liquid jelly on these plates, it is important that they should be level, and also that the jelly should set quickly. For this purpose the following arrangement is employed: A large wooden triangle is supported by three screws, which can be raised or depressed. On this triangle a large piece of glass is placed (Fig. 20). By means of a spirit level and the screws this plate can be made quite level. On this plate a glass dish is set, which is filled quite full with ice and water, and over this another flat piece of glass is placed. The surface of this glass is levelled. On this top piece of glass the glass plate is laid and protected from dust by means of a glass cover. The liquid jelly is poured out on this plate and diffused evenly over it by means of a sterilized glass rod. It sets almost immediately, and can then be placed on a glass tray in the prepared dish, and another plate made, and so on.

The result is that the bacteria being well diffused throughout the jelly, each one that is capable of growing in the material does so, and thus a number of masses or colonies of bacteria appear in a few days throughout the jelly, each of these having presumably started from one individual. Hence, by counting the number of colonies, one may arrive at the number of individual bacteria introduced. Again, experience has shown that different species of bacteria form colonies of different appearances. Some are round, some oval, some smooth, some tuberculated; some have threads shooting out from them into the jelly; some are colored, some not; some cause liquefaction of the gelatine, others do not, and so on. By observing the characteristics of the colonies one may arrive, by means of plate cultivations, at some conclusion as to the species of organism under observation. Again, by means of this method, one can not only enumerate and recognize the bacteria, but can also get pure cultivations from a mixture of different kinds. For if the bacteria and the liquid jelly are thoroughly mixed, and if the jelly solidifies rapidly, each colony will probably start from a single bacterium, and hence each colony will represent a pure cultivation. In separating different kinds, one would not, however, be content with a single plate cultivation; one would make a second set of plates from the colonies on the first. If all the colonies in the second series of plates are similar, one may assume the purity of each, and make test-tube cultivations from them.

The examination of these plates may be carried on with the naked eye, with a pocket lens, or under a low power of the microscope. In the very early stage the colonies are so small that they can only be seen under the microscope, but after a few days they can be seen and recognized by the naked eye or pocket lens. In all examinations microscopic investigation with one-half or one-quarter inch objectives should be combined with the examination by the naked eye or pocket lens. Being an unstained specimen a small diaphragm is, of course, employed.

For any of the purposes for which plate cultivations are employed, it is a disadvantage to have too many colonies on one plate. This may be avoided in various ways. Where the object is simply to get plate cultivations for diagnosis, or for pure cultivations, I generally proceed in this way. Take, say, four tubes of jelly and liquefy them, and, in burning off the tops of the cotton-wool corks, heat also the necks of the tubes. Allow them to cool, and introduce a minute quantity of the material to be tested into tube No. 1. Shake it well, and pour one or two drops from No. 1 tube into No. 2. Shake No. 2 well, and pour a drop or two into No. 3, and so from No. 3 into No. 4. Then make plates from each. In No. 1 plate the colonies will certainly be too numerous, in No. 2 this will also be the case, but in No. 3, and especially in No. 4, only small numbers will be present. The reason for heating the necks of the tubes is to avoid contamination as the jelly is poured from the one tube to the other. Koch's plan is to twist the end of the platinum wire into a small loop (see Fig. 18, C). Dip this loop into the bacteric mixture, and pass it into the jelly in tube No. 1. This is shaken up, and from this tube three loopfuls are carried into tube No. 2 by dipping the loop three times into No. 1, and rinsing it out each time in No. 2. From No. 2, after being shaken up, six loopfuls are transferred to tube No. 3. Plates are then made from each. Where it is necessary to know the number of bacteria in the original material, one must proceed differently. A given quantity, say, fifteen minims, of the original material is added to a given quantity of boiled distilled water, or salt solution (one-half per cent.). This mixture is well shaken up, and then a small quantity (say, two or three minims) is added to each tube of jelly, and from these plate cultivations are then made. In this way, by a simple calculation, the number of bacteria in a given amount of the original material can be ascertained.

Esmarch has introduced a plan of separating bacteria, which is useful in the absence of the apparatus for plate cultivations. Instead of pouring out the contents of the inoculated tube, the latter is turned on its side and rotated, under a stream of cold water, till the jelly solidifies. The whole of the side of the tube is thus lined with a thin layer of jelly in which the individual colonies appear; they can be counted and recognized by means of a pocket lens, or under a low power of the microscope.

Of course, in these processes there is a certain risk of contamination. Contamination from the neck of the tube is avoided by the precaution I suggested before, of heating the neck, and allowing it to cool before pouring out the material. Contamination from the air is avoided by rapidity of movement, and by operating in a still room. The disturbing effects of an accidental contamination are also, to a great extent, neutralized by using the ice, so that the gelatine solidifies quickly, for, if anything falls from the air, it has not time to sink into the jelly, but remains on the surface, and there forms its colonies, while the other organisms are, for the most part, in the interior of the jelly.

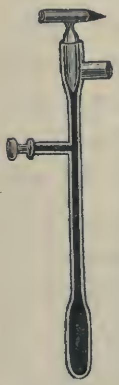
The third method of using nutrient jelly is for glass slide cultivations. For this purpose, either the glass plates before mentioned, or the ordinary microscopic slides are employed. They are sterilized in the usual manner, and are kept, after inoculation, on glass trays in glass vessels, arranged as for plate cultivations. The jelly is liquefied, poured out on the glass slides, and allowed to solidify. When solid, a platinum wire, bent at the end (see Fig. 18, B), and dipped in the material to be tested, is drawn lightly and rapidly over the surface. Generally, a number of slides can be thus prepared without dipping the wire a second time in the mixture. The result of this procedure is that, as the wire passes over the surface of the jelly, it shows the bacteria along its track, and if drawn sufficiently lightly, and rapidly, an organism will only be deposited here and there, especially in the later streaks. There are two advantages of this method. In the first place, it forms one plan of separating bacteria, for many of the colonies are pure cultivations, and are sufficiently distant from one another to enable one to take a pure cultivation from them. And, also, it enables one to test the purity of a cultivation more readily and easily than by means of a plate culture, for, by looking along the needle track under the microscope, one can readily see whether the growth is all of one kind, or whether more than one form is present. The second advantage is, that one can study the mode of spread of certain organisms on the surface of the jelly, and by this means much useful information may be obtained. From these cultures, the beautiful impress preparations previously mentioned are made.

Nutrient jelly is also very useful for cultivating some forms of anaërobes. For this purpose very long tubes are used, which are almost filled with jelly. This is rendered liquid, and then the material containing the supposed anaërobes is introduced and thoroughly shaken up with the jelly. If nothing but anaërobes are present, they will be seen to form colonies deep down in the tube, while a certain thickness of jelly at the upper part remains pure. If both aërobes and anaërobes are present, the former grow at the top and the latter at the bottom. By breaking the lower part of the tube and inoculating fresh tubes in the same manner from the colonies at that part, pure cultivations of the anaërobic organisms will ultimately be obtained.

c. *Agar-agar*. Of all culture materials the nutrient jelly is the most useful, but it has one serious defect, viz., it cannot be placed at the temperature of the human body without melting, when, of course, all the advantages of the solid culture are lost. Other materials which will remain solid at the higher temperature have been tried. Of these the chief is agar-agar, a material derived from certain plants (gracilaria lichenoides). Of this material one to two per cent. is added to a meat infusion mixture, prepared in the same manner as for the gelatine. It is allowed to swell up for twenty-four hours in the ice-safe, and then dissolved in the steaming apparatus. It is extremely difficult material to prepare, and is never quite clear. Hueppe recommends the employment of two layers of filter paper in the funnel, and then a quantity of cotton-wool inside them. It is well in filtering the material to set the whole apparatus in the steaming apparatus, and keep it at 100° C. There is no danger of spoiling the solidity of the material by heating it too much. When prepared, it is introduced into and preserved in test-tubes in the same way as the gelatine material. As a rule, the test-tubes are allowed to solidify obliquely. Agar-agar may be used for test-tube, plate, or glass slide cultivations. In using it for plate cultivations great care must be taken not to kill the bacteria introduced, for the agar does not become fluid below 42° C. The best way is to have a vessel of water at 42° C. at hand. Melt the agar tube in the steamer, and then place it in this water until the temperature of the whole is 42° C. Then add the bacteria, shake up, and pour out rapidly on a glass plate.

The temperature of 37° C. is maintained by means of an incubator, of which there are various forms. They all essentially consist of double-walled copper or tin vessels with either a lid or a door which is also double-walled. The space between the walls is filled with water. A thermometer passes through a hole in the top into the interior, and a gas regulator passes into the water to regulate the supply of gas to the burner. There are various kinds of gas regulators. The one most frequently employed is mercurial, of which Reichert's is the best form (Fig 21). It consists of a long tube, bulbous at the bottom, narrow in the middle, and wide at the top. To the narrow part at the side is attached a wider piece of glass tube, closed with metal, in which a screw works. The upper wider part is ground inside, and has a lateral tube, which is connected by India-rubber tubing with the gas-burner. Into the upper part is inserted a T-shaped piece of glass tubing, ground on the outer side of the upper part of the leg of the T, and tapering toward the end inserted into the long tube. This tubing is open at two ends; at the outer, or larger end, it is connected with the gas supply. At the lower end, the opening is comparatively small, while about the middle of the descending arm, and opposite the large exit from the long tube, is a minute hole. The bulb is filled with mercury, which passes up the narrow tube and fills the lateral tube on the narrow part. The transverse arm of the T-shaped top piece is connected by India-rubber tubing with the gas supply. The action of the apparatus is as follows: At first, gas flows freely into the

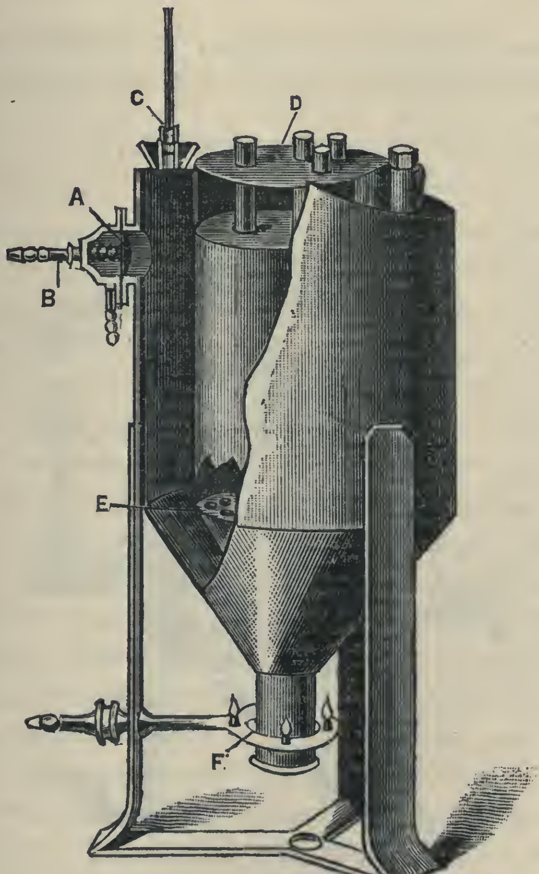
FIG. 21.



Reichert's gas regulator.

T-shaped piece, and thence through both holes into the upper chamber of the long tube, from which it passes on to the gas-burner through the lateral tube. As the water becomes warm, the mercury rises in the narrow tube until ultimately it gets into the upper dilated part, and closes up the lower and larger exit for the gas. Hence gas only passes to the burner through the minute lateral hole, and the flame diminishes. As the water again cools the mercury falls, until at length the lower hole of the tube is freed, and a full flow of gas again takes place. By this alternate rising and falling of the flame, the interior of the chamber is kept at a constant temperature. The regulation for a definite temperature (say 37° C.) is done in this way: The screw of the lateral tube is unscrewed as far as it will go. When the temperature has reached

FIG. 22.



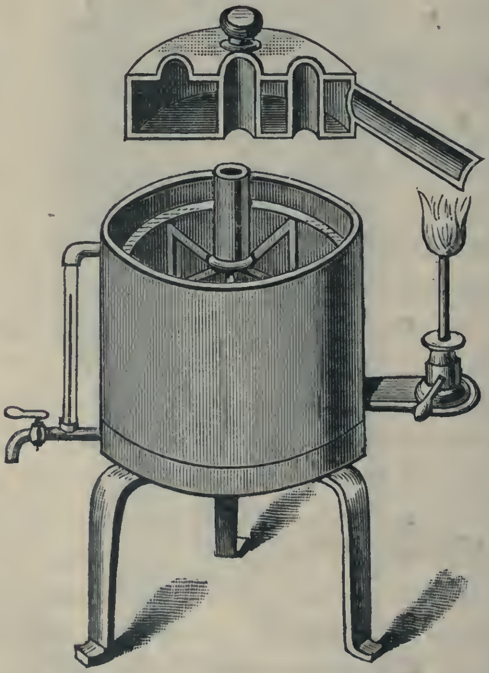
Outline of d'Arsonval's incubator. A, India-rubber diaphragm. B, gas tube. C, plug and tube at the top. D, lid. E, tray on which cultures are placed. F, gas-burners.

about 36° C. this screw is screwed in, and in doing so displaces the mercury and causes it to rise into the wide top. The lateral screw is screwed in until the lower exit for the gas is shut off, and the flame goes down. Should the small lateral hole still allow too much gas to escape, it can be diminished by turning round the top piece until the hole is almost closed by the wall of the long tube. The most perfect incubator is the d'Arsonval machine made by Wiessnegg, of Paris, and outlined in Fig. 22. In it, the regulation occurs by the expansion of the water forcing out an India-rubber diaphragm (A) against the gas tube (B). In this case boiled water must be introduced into the machine, in order that the regulation may occur solely by expansion of water and not be complicated by expansion of gas.

Agar jelly has many disadvantages and hence is not, as a rule, much used except to maintain pure cultivations of microörganisms which only grow at the temperature of the body. It is difficult to make, never quite clear, difficult to utilize for plate cultivations, and the different bacteria do not grow with characteristically distinct features to such an extent as on gelatinized materials, and thus its diagnostic properties are less.

d. Blood serum. For the cultivation of tubercle bacilli and other organisms Koch has introduced coagulated blood serum. The blood of sheep, cattle, etc., is received into a long, narrow clean vessel and allowed to stand in the ice safe for twenty-four or thirty-six hours till the serum has separated. The clear serum is then drawn off and introduced into sterilized test-tubes. In his earlier method Koch placed these tubes in an apparatus (a sort of incubator, Fig. 23) regulated for a temperature of 58° C. to 60° C. They were kept in this for an hour at a time, and

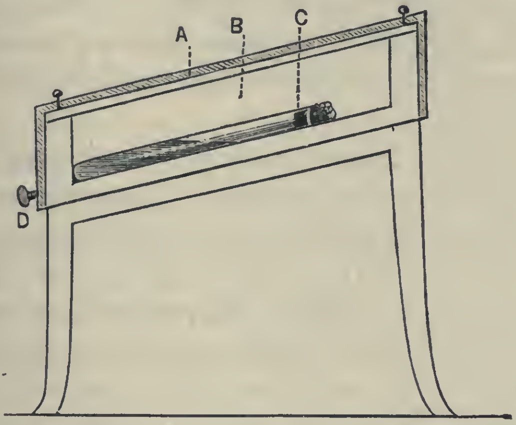
FIG. 23.



Koch's apparatus for sterilizing blood serum.

this was repeated every day for six days in succession. At this temperature the serum does not solidify while all the adult bacteria are killed, and on Tyndall's principle the spores sprout in the interval between the heatings, and after two or three heatings all the bacteria are destroyed. At the end of six days the tubes were laid on the bottom of another water bath which could be placed obliquely (Fig. 24), and was provided with a glass top through which the tubes could be seen. This top was covered with felt when not used. The temperature was then raised to from 65° C. to 70° C., at which the albumen coagulated, and when the serum was sufficiently firm the tubes were removed and placed in an incubator for two or three days to see if they were sterile. If the temperature is not raised above 70° C., the serum is fairly clear. (Of late, Koch has been content with simply solidifying the serum slowly at 65° C. at once without the preliminary exposures to 58° C. A certain number of tubes remain pure, but a considerable number are lost in this method.) When the serum has solidified and is allowed to cool, a little condensed steam runs down the sides of the tube and forms a drop of water at the lower part of the oblique surface of the blood serum. In order to be able to look at the growth with the microscope, the serum is sometimes solidified in little glass capsules provided with a glass cover and the bacteria are sown on this by stroking it with the platinum wire.

FIG. 24.



Koch's apparatus for solidifying blood serum. Lateral view. (After Hueppe.)

The blood serum is a very good cultivating medium for certain bacteria, more especially for tubercle bacilli, but it is troublesome to make and by no means the best medium for many other kinds. Hence its use is mainly limited to tubercle and glanders bacilli. After a few days in the incubator the upper part of the oblique surface of the blood serum dries up, and as the tubercle bacilli grow very slowly it is important to avoid this. This may be done by fixing a small India-rubber cap over the mouth of the tube, but this is dangerous because, if spores of fungi have fallen on the cotton-wool, they grow down through the plug, which is, of course, quite moist under the cap, and fall on to and spoil the cultivation. To prevent this the top of the cotton-wool plug must be burned and washed with sublimate solution (1:1000), and the India-rubber cap must also be washed with the same solution before it is applied.

Various other modifications of these solid media have been used. Löffler, in cultivating the diphtheritic bacillus, added to three parts of the blood serum one part of a neutralized filtered meat infusion, containing 1 per cent. peptone, 1 per cent. grape sugar, and 0.5 per cent. chloride of sodium. The serum was then sterilized and solidified in the manner just described.

e. Pastes. For fungi, pastes made of bread, crushed potato, horse dung, various fruits, etc., are very useful. These are made up to a thick paste, introduced into sterilized Erlenmeyer's flasks and sterilized in the usual manner. They are also useful for various bacteria.

Pure cultivations of the various microörganisms may either be obtained from mixtures of various kinds, such as one commonly finds in decomposing materials, etc., or if pathogenic they may be obtained from the affected organism. Most forms can be readily obtained from mixtures by means of gelatine or agar plate cultivations, or, if anaërobes, by means of the long tubes previously described, but in some cases where they grow slowly they either cannot be got at all, or must be obtained from some place where they already exist pure. Take, for example, the tubercle bacillus in sputum. The tubercle bacillus grows extremely slowly outside the body, while sputum contains large numbers of other bacteria which grow very rapidly, hence any attempt to obtain the tubercle bacillus pure by means of glass plate cultivations, or, indeed, in any other way as yet known, must prove a failure. They can, however, be obtained pure by introducing them into a soil in which they will grow and in which the other forms will not. Such a soil is the animal body, but it is quite possible that a similar artificial soil might be prepared, though this has not yet been done for tubercle. I have, however, in the case of certain parasitic skin diseases, more especially in *tinea tonsurans,* obtained pure cultivations of the pathogenic fungus by providing a soil which was unsuitable for the growth of the bacilli and micrococci which swarm on the hairs and yet permitted the growth of the fungus. Such a soil was obtained by adding small quantities of citric acid and extract of nux vomica to the ordinary nutrient jelly. In the case of other slow-growing and spore-bearing organisms, it might be possible to get them pure by adding an antiseptic to the mixture so as to kill the other bacteria, and then, washing the antiseptic away and sowing the material, the spores which would alone survive would grow. Or, it might be done by heating the mixture, as spores resist heat. In such a case one must suppose that only spores of the particular organisms to be cultivated are present in the mixture.

In the case of pathogenic organisms it is best to get them from the body of the animal affected. If they are present in the blood this is easily done by killing the animal, tying it out on its back on a board, and washing the hair and skin over the thorax thoroughly with sublimate solution (1 : 500). A number of knives, scissors, and forceps are heated in the gas-flame and allowed to cool. With one the skin is divided; this knife is then heated and laid aside. With another the skin is dissected off the thorax. With a pair of scissors the ribs (in rabbits and guinea-pigs) are cut through, and with a fresh knife the sternum is dissected up. Again, with fresh scissors and forceps, the heart is seized and opened, and a pure platinum needle is dipped in the blood. The glass slide cultivations should be used in the first instance, for by this means, if there were more than one kind of organism present in the blood, or if any accidental contamination occurred, this would be at once detected by examining the line of growth, and pure cultivations could be obtained from a pure spot. If, on the other hand, a test-tube were at once inoculated, and an impurity were present, an impure cultivation would be obtained, and might lead to error, as indeed it has often done. Where the bacteria are not present in the blood but in the organs, the body is opened in the same manner; a slice is made into the organ, and a minute piece cut out with pure scissors, and sown on the surface of the gelatine or agar. It sometimes happens that the animal has been dead for some time before it is examined. In that case the outside of the organ may be covered with bacteria, and therefore it must be washed with sublimate solution, and a cut made almost across it with a pure knife. As the knife may have carried in bacteria from the outside, a fresh cut is made at right angles to this with a fresh knife, and to make assurance doubly sure, a third cut is made at right angles to the second, with a third knife. From the deeper part of this third cut small pieces are taken and used for plate cultivations, glass slide cultivations, etc. These are examples of the methods of procedure; they must be modified and adapted to the particular cases in question.

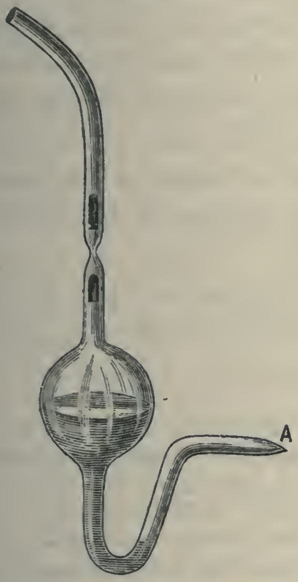
These methods of cultivation are also much used for the purpose of ascertaining the number and kinds of bacteria in water, earth, and air, and the results, though not quite exact, nevertheless give a great deal of useful information. The results are not as yet exact, because in the first instance we do not as yet know all the pathogenic organisms, and therefore bacteria may grow which we do not recognize as pathogenic. In the second place, all the pathogenic organisms may not grow on the soil employed or in the presence of oxygen, and yet these special forms may be present in large numbers in the material tested. And in the third place, they may grow so slowly that the culture material may be completely invaded by other forms before there has been time for the colonies of the pathogenic organism to become visible. In spite of these disadvantages, however, much information may be obtained as to the sanitary conditions of water and air in particular localities, for the presence of a large number of bacteria in a water indicates contamination and the existence of an amount of pabulum which ought not to be there.

The examination of earth is easily carried out by pounding up some of the earth to a fine dust in a sterilized mortar with a sterilized pestle. A minute quantity is then picked up on the point of a sterilized penknife and scattered over the surface of the nutrient jelly which has been poured out on a glass slide and allowed to solidify (glass slide cultivation). Under the microscope it will be seen that growth starts from the majority of the particles of earth, and if the earth has been pounded up sufficiently fine most of these centres of growth will be pure cultivations. Hueppe recommends that as anaërobes are always present in earth, some of the slides should be covered with a thin strip of mica. He also suggests that a quantitative analysis of earth may be made by mixing a certain weight of the powdered earth with a certain quantity of boiled water, and then testing this in the same manner as water. This method, however, can only yield imperfect results, as the earth quickly subsides, and it is not easy to distribute the bacteria equally through the water, many of them remaining adherent to the particles of earth. Koch has shown that the majority of the bacteria in earth are close to the surface, while deep down only spores and anaërobic forms are present.

In testing water one has to take into account both the numbers and the kinds of bacteria present. The water to be tested must be received into sterilized vessels and corked with a sterilized cork or glass stopper. A definite quantity is mixed with the nutrient jelly, and plate cultivations are made. As a rule, in the case of filtered water eight to sixteen minims may be added to three drachms of jelly without much risk of having too many colonies as a result; but with unfiltered water, or very impure water, much smaller quantities must be used, and indeed in some cases the water must be still further diluted by adding a known quantity to a given amount of boiled distilled water, and then using a certain quantity of the mixture for the cultivation. For ease in counting the colonies, when these are numerous, the glass plate is laid on a piece of black cardboard divided into small squares. By counting the number of colonies present in several of the squares, and by ascertaining the number of squares occupied by the jelly, a fairly accurate estimate of the numbers can be arrived at.

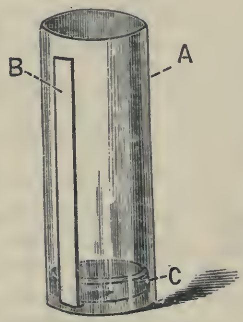
Air may be tested in various ways. By the older plans the air was aspirated over glycerine-covered surfaces, or through gun-cotton which was afterward dissolved in alcohol and ether and in other ways, and the dust so collected was subjected to microscopical investigation. The results of this plan are practically *nil*, for it is impossible to recognize among the débris what are and what are not living organisms, nor what species are present. Hence, resort is now always had to cultivation experiments. Miquel, who has done most work on this subject, uses for the most part vessels of the shape shown in Fig. 25, containing cultivating fluids. A large number of these vessels are prepared and the pointed extremity, A, being broken off, a known quantity of air is drawn through each. The end A is again sealed and the bulbs set aside in a warm place (*e. g.*, an incubator) for development. A certain number of bulbs show development, a certain number remain pure. By counting the number in which development occurs and ascertaining the total quantity of air drawn through all the flasks Miquel estimates the number of bacteria in that amount of air. This method is totally untrustworthy and fallacious, for there is no certainty that development in each flask occurred from only one germ, there is no possibility even on microscopical examination of determining whether each is a pure cultivation or not, and one cannot tell what kinds are present.

FIG. 25.



Miquel's bulb for testing air by means of cultivation. (After Hueppe.)

FIG. 26.



Koch's apparatus for testing air. A, glass cylinder. B, strip of brass or tin. C, glass capsule for jelly.

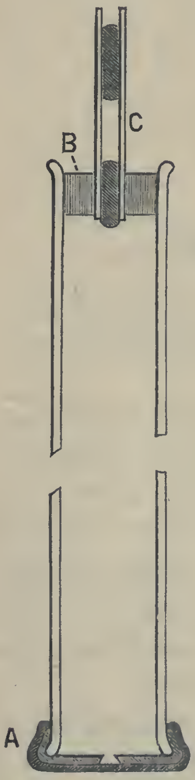
Hueppe's method is a great improvement on this. He aspirates a definite quantity of air through a certain amount of culture fluid and then, shaking the flask well to distribute the bacteria equally through the fluid, he makes plate cultivations with known quantities of the fluid in nutrient jelly and agar, testing the mixture of air and culture fluid in the same way that water is tested.

Koch employed a glass cylinder six centimetres in diameter and eighteen centimetres high (Fig. 26, A), at the bottom of which is placed a flat glass capsule, C, to hold the jelly; this glass capsule can be easily lifted out of the cylinder by means of a piece of tin bent at right angles, B. The cylinder, capsule, and strip of tin are cleaned, the cylinder plugged with cotton-wool and the whole sterilized in the hot box. When the vessel has cooled the cotton plug is removed, the capsule lifted to the margin of the cylinder, half filled with nutrient jelly (for this purpose Koch used a wheat infusion jelly), replaced, and the cylinder immediately replugged with the wool. Any organisms which fall in during these manipulations sink into the jelly and develop in its interior and not on the surface. When the jelly has set, the vessel is taken to the place where the air is to be tested, the plug removed and placed in a sterilized vessel and the cylinder left open for some time (even for some hours). Dust falls on to the jelly and after a sufficient length of time the plug is reinserted and the apparatus set aside for development. Growth occurs at various points on the surface of the jelly. This method gives a rough estimate of the kinds of organisms present in the air, but does not give any accurate account of the numbers present in a given quantity.

Hesse has devised an elaborate apparatus for quantitative analysis, of which the following account may be given from his paper:

"The method devised by me, and employed in my investigations, consists essentially in drawing air through long tubes, the walls of which are covered with a layer of solidified nutrient jelly. The current of air is regulated and measured by means of an aspirator. From the number of colonies which develop on the jelly, and from the quantity of air employed, an accurate estimate is obtained of the number of germs in the air. This, however, gives only the number of germs which come in contact with the nutrient jelly, and which can grow under the conditions under which they are placed, such as at the temperature and on the nutrient soil employed."

Fig. 27.



Tube used in Hesse's method of testing air. A, end covered with the caoutchouc caps. B, caoutchouc cork. C, glass tube.

Apparatus.—For these experiments one requires glass tubing, nutrient jelly, and an aspirator.

"*Glass tubing.* The most convenient tubes to employ are about 70 cm. long and 3.5 cm. broad, having a capacity of about forty cubic inches. The tubes, the edges of which at each end are somewhat thickened or bent outward, are now prepared for the reception of the jelly; over one end a closely fitting caoutchouc cap is fastened, having a central hole of about one centimetre in diameter, and over this a second entire cap is placed; in this way the tube is completely closed at this end (Fig. 27, A). If one applies only a single cap over the end of the tube, as I did in my early experiments, there is a danger of detaching the jelly from the glass when the cap is removed, and, therefore, I used to cut out a small central hole in the cap before the commencement of the experiment; but by the use of two caps there is no danger of disturbance of the jelly by the removal of the outer cap.

"Into these tubes 50 c. cm. of fluid nutrient jelly are introduced by means of a pipette. This quantity is sufficient to cover the inner wall of the tube completely.

"Into the other end of the tube now containing the jelly a tightly fitting caoutchouc cork (Fig. 27, B) about 2 cm. in diameter is introduced. The central part of this cork is perforated with a hole about 1 cm. in diameter, and through this passes a piece of glass tubing, C, about 10 cm. long and 1 cm. wide, and containing two plugs of cotton-wool. The plug nearest the large tube projects a little beyond the end of the small glass tube. This small piece of tubing is for the purpose of easily connecting the large tube with the aspirator, of equalizing the atmospheric pressure inside and outside the tube, and of acting as a filter for the air. The use of the two wool plugs is in order to meet requirements to be referred to later, which make it desirable to remove a part of the contents or to alter the position.

"The tubes, etc., are by no means free from micro-organisms even though the greatest care and cleanliness be observed. Although these accidental impurities could be recognized from the position in which the colonies appear (mostly in the substance of the gelatine), nevertheless, in consequence of their further development the result of the experiment would not be satisfactory; and further, the innermost wool plug, which, as will be later seen, is employed to control the accuracy of the experiment, would, on account of its contamination, be useless for that purpose; hence, it is necessary to destroy these organisms. This is most conveniently done by exposing the tube with the gelatine, etc., for one or two hours to a current of steam at or near 100° C. For this purpose I employ an apparatus similar to that described by Koch, Gaffky, and Löffler (*Mittheilungen aus d. Gesundheitsamtes*, p. 332). By means of it six tubes can be sterilized at one time. It consists of a cylindrical tin vessel about 1 metre high and 13 cm. wide, covered with a tin cap and surrounded by felt; this cylinder is fixed on the top of a tin vessel 20 cm. high and 13.5 cm. wide, filled with water.

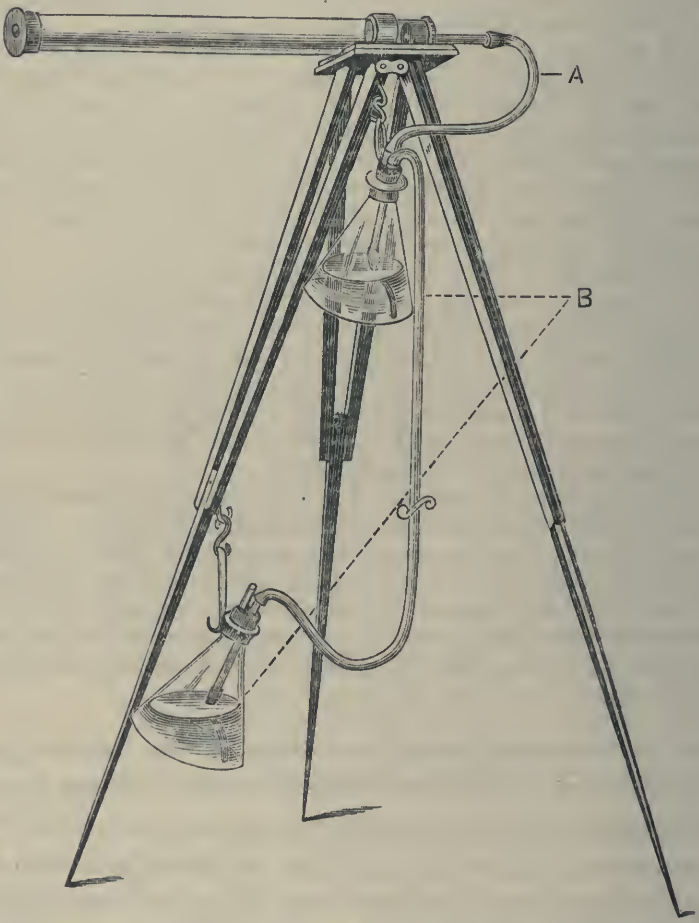
"After the tube has been removed from the steaming apparatus, and while the jelly is still fluid, it is moved in various directions under a cold water tap till the jelly solidifies. Thus an even coating over the whole tube is obtained, but in later experiments it was not found necessary to have the whole wall of the tube covered, as the organisms fell on the side on which the tube lay. The tube is now washed externally in a 1 per cent. corrosive sublimate solution, and fixed horizontally on a stand." (This stand is somewhat similar to that used in photography. See Fig. 28.)

By means of an elastic tube (A) attached to the narrow glass tubing the aspirator (B) is now connected with this tube. (Hesse generally uses two 10 litre flasks.) The one nearest the apparatus is filled with water, the other is empty. By setting a siphon arrangement into action the water flows from the upper into the lower flask, and the air which takes its place must pass through the apparatus. The rapidity of flow is easily regulated by a stopcock. When everything is ready, the outer caoutchouc cap over the end of the large tube is removed, and the water is made to flow from the upper to the lower flask at a moderate rate. It was found experimentally that all the dust was deposited in the large tube, unless the flow was very rapid. After a sufficient quantity of air has been drawn through, the aspirator is detached, the outer cap reapplied, and the tube laid horizontally at a suitable temperature (20° to 25° C.). In two or three days colonies are evident, and may then be counted and investigated.

None of these methods are quite satisfactory, and a good deal remains to be done in the way of improving this line of research. Probably by using both Hesse's and Hueppe's plans useful results would be obtained.

A very important application of these culture methods is to test the value of antiseptics. The older plans for testing antiseptics were either to add a certain quantity of the antiseptic to cultivating fluids and then inoculate with some putrid material, to see if growth occurred, or to add the antiseptic substance in a certain quantity to the mixture of bacteria, and then from this to inoculate a cultivating fluid. There are several objections to this plan. For example, as the special forms of bacteria tested were not known there was no certainty that the resulting growth was not accidental. Again, no account was taken of whether the bacteria acted on were in the spore or the adult condition.

FIG. 28.



Hesse's apparatus for testing air fixed on its stand and ready for use. A, elastic tube connecting the glass tubing with the aspirator. B, the aspirator.

Koch improved this method very much by using only known and well-characterized bacteria in his experiments, by ascertaining whether spores were present or not, and by employing solid culture media, and thus shutting out the confusion which might arise on account of accidental contamination. He also increased the certainty of his results by employing pathogenic bacteria, such as the anthrax bacillus, and afterward testing the result by inoculation of suitable animals. In the first place, he prepared a number of small pieces of cotton threads by putting them into a tube plugged with cotton-wool and sterilizing them. He then made a copious cultivation of the organisms or spores to be tested, soaked a number of the threads in the cultivation, laid them in a sterilized watch-glass, and placed them in a drying chamber over sulphuric acid. In the dry state non-spore-bearing bacteria may live three or four days; spores live a long time. He used cultivations of a large number of well-known organisms, such as Micrococcus prodigiosus for non-spore-bearing bacteria, and anthrax spores for spore-bearing organisms. The threads, when dry, were steeped for various lengths of time in solutions of the antiseptic of different strengths, then taken out and washed in boiled distilled water, or in alcohol and ether, and laid on potato, or on jelly poured out on glass slides. In a few days it was evident whether growth had occurred or not, and it was easy to determine if the growth resulted from an accidental contamination, or from the organisms tested. For, if the latter, the growth would start from the threads, and would also show the characteristics of the organism in question, such as the color of Micrococcus prodigiosus on potato, or the peculiar network growth of Bacillus anthracis on jelly.

In testing the effect of acids on the cholera bacillus,[1] I adopted a different plan, which, I think, has advantages over the other, in some cases. A cultivation of the organism in question in fluids is prepared, and a certain quantity of this cultivation is added to a certain quantity of a solution of known strength of the antiseptic to be tested, well mixed, and allowed to stand for a definite time. Tubes containing liquefied jelly are then taken, and a drop of the mixture of bacteria and antiseptic is added; they are then shaken up, and plate cultivations prepared. Control experiments are, of course, made to make sure that the amount of antiseptic thus added to the jelly is not sufficient to prevent growth. The jelly is already liquefied before the drop of the mixture is added to it, in order that the antiseptic may be at once diffused through the liquid, and not continue to act on the bacteria for a longer time than was intended.

III. The Study of Bacteria in Relation to the Living Body.

In the case of all pathogenic organisms it is necessary for complete proof that they are the cause of a particular disease to show that, on their introduction into an animal of a species susceptible to the disease, they set up the disease in question. Experiments on animals are also required in the case of bacteria, in order to study the mode of infection and many other points in the natural history of the disease. The method of infection varies in different diseases, but the following are the chief modes employed:

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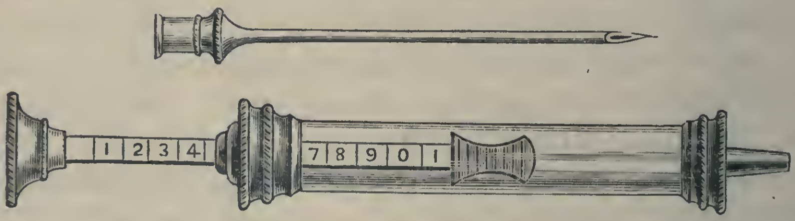
[1] See Report on the Cholera Bacillus, British Medical Journal, May, 1885.

A. Cutaneous Inoculation.—Here a wound is made in the skin, but does not pass into the subcutaneous tissue. A portion of the body is selected which the animal cannot lick, and for this purpose the ear is generally chosen. The hair is shaved off, and the skin washed with sublimate solution (1 : 500), which is again removed with boiled water. The skin is then scratched with a sharp lancet, as in vaccination, and the infective material rubbed into the scratch. This mode of infection acts well with certain organisms, such as anthrax, mouse septicæmia, chicken cholera, etc.

B. Subcutaneous Inoculation.—Other organisms, such as the bacillus of malignant œdema, the tubercle bacillus, etc., must be introduced into a pocket in the subcutaneous tissue. The most convenient places for this pocket are, in guinea-pigs on the front or side of the abdomen, in rabbits at the base of the ear, in mice at the root of the tail. The skin is shaved and disinfected in the manner before described, and a small incision is then made through it with a pair of sharp scissors. With some blunt instrument a pouch is then formed in the subcutaneous tissue, and into this the material to be tested is introduced by means of a platinum wire, point of a knife, etc. After it is introduced the skin is rubbed over the place so as to diffuse the material, and, if necessary, the wound may be dressed with a bit of salicylic wool and collodion.

C. Subcutaneous Injection.—The back or the front of the abdomen, and the root of the ear or of the tail, are the situations most frequently selected. The skin is shaved and disinfected as before. The material is drawn up into a syringe of special construction, and the desired quantity is injected. The older form of syringe introduced by Koch (Fig. 29) consisted of a glass tube, on each end of which the thread of a screw is cut, and the metal fittings are thus screwed directly on to the glass. The piston is graduated, and the bulbous metal end is hollowed in the middle, and does not fill up the calibre of the tube; a sufficient amount of cotton or asbestos thread is wrapped around this end of the piston to make it fit the tube accurately. The washers are

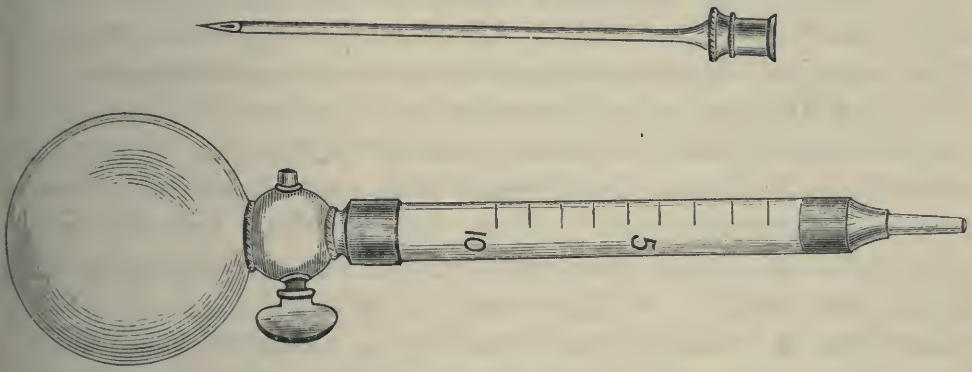
Fig. 29.



Koch's syringe for experiments on animals—old pattern.

made of thin pieces of cork. After each injection the cotton thread and the washers are removed and the syringe is washed. Before use, fresh thread and washers are arranged, and the whole is purified in the hot box. Of late, Koch has introduced a much simpler and more efficient form of syringe (Fig. 30). It consists of a straight piece of glass tubing graduated in tenths of a cubic centimetre, the outer side of each end being ground. Over each end metal fittings are attached; one taking the needle of the syringe, and the other having affixed to it an India-rubber ball with a hole at the top and a stopcock between it and the syringe. The tube and the lower metal attachment can be sterilized in the hot box or by heating them directly in the flame; the upper part does not require to be sterilized, as it does not come in contact with the injection fluid. By pressing the ball with the thumb over the hole, the contents of the tube are expelled, and the tube is filled by emptying the ball by pressure, and then allowing it to fill gradually by relaxing the ball, the end of the needle being dipped in the fluid. When sufficient material has been drawn up, the stopcock is turned. By means of these syringes, injections may be made not only into the subcutaneous tissue, but also into the cavities of the body (abdomen or pleura).

Fig. 30.



Koch's syringe for experiments on animals—new pattern.

D. Intravenous Injections may be Made into the Jugular Vein or into one of the Aural Veins.—If the injection is to be made into the jugular vein, the animal must be chloroformed and tied out on its back. The skin being shaved and disinfected, and the knives, forceps, etc., also disinfected, an incision is made over the jugular vein on one side, a double ligature passed round it, and between the two ligatures a small V-shaped incision is made into the vein, into which the nozzle of the canula is introduced and tied; the vein is also tied above. Injection may be made by a syringe through the canula, but I have always found it best when large quantities were introduced to use a burette, and let the fluid pass in slowly and without any force.

It is much simpler to inject into the aural vein. A vein is selected at the outer side of the edge of the ear, where the skin does not move over the vein, nor the vein over the cartilage. The skin is shaved and then disinfected, and then the needle of one of Koch's syringes is pushed directly into the vein and the material injected. It is easy to see if the needle is in the vein, and whether the injection flows properly or not.

E. The eye may be very conveniently used for inoculation, as it allows one to observe what takes place afterward. In some cases the cornea only is inoculated by pricking it with an infected needle and the spread of the organisms along the spaces in the cornea can be observed.

The most frequent mode of using the eye is, however, to introduce the infective material into the anterior chamber of the eye. This is more especially useful in the case of bacteria which grow slowly and do not set up much inflammation, such as the tubercle bacillus. In fact, in regard to tubercle, this method has been most valuable in clearing up many points, more especially in disproving the assertions as to the origin of tuberculosis as a result of the introduction of non-tuberculous material into rodents. When non-tuberculous material such as pieces of glass, cork, etc., were introduced into the abdominal cavity and the animal died afterward of tuberculosis, it might have been that the material set up the tuberculous process, or on the other hand that the occurrence of tuberculosis was independent of the operation. When tuberculous material is introduced into the anterior chamber of the eye of a rabbit, it remains there for some days without apparently causing any disturbance—in fact, gradually dwindling away, till in about twenty-one days an eruption of tubercle is noticed on the iris, and thence the disease spreads, affecting the whole eye and in most instances spreading to the body and setting up general tuberculosis. This iris tuberculosis always occurs. If a piece of cork or other non-tuberculous material is introduced into the anterior chamber of the eye, it is not followed by an iris tuberculosis, and should the animal afterward die of general tuberculosis (which occurs extremely rarely), it is thus known that the disease was accidental and independent of the operation. In introducing the material the eye is fixed and a small incision is made at the upper part of the cornea into the anterior chamber, care being taken as the knife is withdrawn that the iris does not prolapse. The material is then pushed into the anterior chamber through this opening by means of a blunt needle. Fluids may also be injected into the anterior chamber by Koch's syringe, the needle being pushed obliquely through the upper part of the cornea.

F. Inhalation.—In some cases it is necessary to test the effect of inhalation of virulent material in producing disease. In doing so the experimenter must, as a rule, guard against the danger to himself. The infective material may be furnished for inhalation either in the form of spray or as dust. In the case of spray the animals are placed in a box nto which the nozzle of a hand spray-producer projects. The retort of he spray contains the infective mixture, and the operator is separated rom the spray by a long India-rubber tube. If necessary, he may hield himself by means of a respirator; but, as a rule, the box can be laced in the open air and at such a distance away that he is in no danger.

Spore-bearing organisms may be used in the form of dust, which may e either blown into the vessel containing the animal or placed on the loor of the vessel, which is then shaken to raise the dust.

G. Infection by the Food.—This mode of experimentation is used o test the possibility of infection from the intestine, and in carrying it ut there are two points to be attended to: care must be taken, first, hat infection does not occur from the mouth or throat; and, secondly, hat the infective material is not destroyed in the stomach. At first the xperiments were made by simply mixing the infective material with the food, but in these cases infection often occurred from the mouth and throat. To avoid this, Koch adopted the plan of taking two small slices of boiled potato, scooping out a small depression in each piece, filling this depression with the bacteria, placing the two slices in apposition so that the bacteria were enclosed in the potato, and pushing the piece of potato to the back of the tongue so that it was swallowed at once without being chewed.

As regards the second danger, it is only present in the case of non-spore-bearing bacteria. Spores are able to resist the action of the gastric juice, whereas adult forms are, as a rule, destroyed by it. In the case of the cholera bacillus, Koch has devised a plan in the case of guinea-pigs by which the bacilli escape the action of the gastric juice. He first neutralizes the contents of the stomach by introducing into it eighty minims of a five per cent. solution of carbonate of soda. Ten minutes later a culture of the cholera bacillus is injected through a stomach tube (catheter). Lest the bacteria, which thus escape the action of the gastric juice and enter the intestine alive, should pass too rapidly through the small intestine, he then injects a solution of opium into the abdominal cavity (sixteen minims of the tincture for every six ounces of the weight of the animal). Koch hopes that this plan will prove useful in testing other forms of bacteria.

THE ETIOLOGY AND MECHANISM OF ASTHMA.

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No subject in medicine has given rise to greater discussion or criticism than that included in the term "Asthma." It was indiscriminately applied by the older writers to dyspnœa arising from various causes, and at the present time, although the majority confine the term to paroxysmal dyspnœa, accompanied by characteristic physical signs, still we find it used in a loose way to describe dyspnœa due to entirely different pathological conditions.

In this article I wish to confine the term to the paroxysmal dyspnœa which is always characterized by positive physical signs. I will exclude from consideration all other forms. Cardiac asthma due to a weakening of the heart, is not asthma; nor can we include the smothering of pure emphysema, although emphysema may be complicated with asthma. Suffocative attacks of bronchitis belong to the latter disease, although asthma may be also engrafted upon it and immeasurably increase the distress of the sufferer. In various diseases of the nervous system there is marked and paroxysmal dyspnœa, but the physical signs of asthma are always absent.

The older writers divided asthma into idiopathic or essential, and reflex. In the class of idiopathic asthmas were included all for which no reflex origin could be discovered; whilst in those classed as reflex, the point of irritation was mainly found in the bronchi and the mucous membrane of the gastro-enteric canal, the uterus, or the uterine appendages. The number of reflex cases was limited, and the large majority of cases were classified as idiopathic.

Modern investigations have proven that asthma of reflex origin is the most common, and at the present day it seems not improbable that those cases for which no local point of irritation can be discovered, and which seem idiopathic in character, will, by later investigators, be brought into the reflex class. Emotional asthma seems to be most certainly of the essential character; but when we consider it as analogous to vasomotor disturbances of the skin seen in emotional states, causing blushing or pallor, we may find a reflex origin through some of the senses.

Voltalini first drew attention to asthma dependent on the presence of nasal polypi, and showed that the removal of the polypi was followed by a cessation of the asthma. Later investigations have proven that it is not the polypi alone, but rather the peculiar condition of the nasal chamber in which the polypi are found that is the immediate cause of the asthmatic attack. Hack and John Mackenzie, of Baltimore, have especially drawn attention to the fact that a condition of congestion is at times present, and that the cavernous tissues of the turbinated bones become hyperæsthetic. They have endeavored to prove that the special sensitive areas are found either at the anterior or posterior extremities of the turbinated bones. It has now, however, been proven that the whole surface of the membrane is involved more or less in this sensitive area. In this sensitive condition, the presence of an irritant is capable of producing the asthmatic paroxysm. A polypus touching the sensitive area, retained secretions, dust, intense light, or anything capable f producing an impression on the nasal mucous membrane will provoke he attack. Even a swollen condition of the mucous membrane allowng a lateral pressure between the septum and the cavernous bodies, eems to be a provoking cause. That a nasal polypus alone is not capable of producing asthma, is shown by a case in which I removed a polypus from the lower turbinated bone with complete cessation of the asthmatic symptoms, although the upper portion of the chamber was till filled with nasal polypi. The asthma subsequently returned on a recurrence of the lower polypus.

In the pharynx we find an immediate cause in the presence of hyperesthetic, enlarged follicles. In a case of this character the asthma was modified by an application to the group of follicles, and disappeared after the destruction of the same.

In 1882 I presented to the American Laryngological Society a paper ermed "Laryngeal Asthma." In this article I sought to prove the connection between a hyperæmic or inflamed condition of the larynx and the asthmatic paroxysm. I cited several cases where the asthmatic paroxysm had been modified or entirely removed by the application of an anæsthetic or astringent solution to the larynx. The sensitive area s especially the inter-arytenoidal space and the membrane over the arytenoid cartilages. Since then I have seen a large number of these cases, and will cite the following as illustrative:

Through a misplacement of bottles, I pencilled the larynx of a man suffering with a severe asthmatic paroxysm, with a fifty per cent. solution of carbolic acid. The application caused intense burning, and the patient was able to swallow with great difficulty for several days. The asthmatic paroxysm, however, *was instantly broken on the application of the brush*, and since then he has been entirely free from asthma. I could report many cases in which the spasm has been instantly modified or entirely broken by the application to the larynx of a mild solution of carbolized iodine, or the insufflation of morphia powder. From the success of this form of treatment, the immediate and at times almost instantaneous relief given, I feel justified in saying that the sensitive area of the larynx, in a large number of cases, is the site of localized irritation provoking the asthmatic attack. From a study of a large number of asthmatics, I am fully convinced that the local site of irritation in the greater number lies in the upper air-passages. Störck, Nothnagel, Longet, and Schiff, have demonstrated that the sensitive cough area is located in the inter-arytenoidal space, the posterior surface of the trachea, and at the bifurcation of the bronchi. Later investigators (Hack, Haring, John Mackenzie, Daly, and Roe) have added to these the surface of the lower and middle turbinated bones.

Many cases of so-called bronchial asthma have their site of irritation in the nares, in the larynx, and probably in the posterior surface of the trachea, and the bifurcation of the bronchi. Cases of asthma caused by odors, the effluvia of animals, and the smell of flowers, or light, are due probably to a pathological condition of the nares. I am also inclined to believe that asthma due to emotional or psychical influence may in certain cases be due to the same cause. It is fully recognized that the so-called vasomotor catarrh, with turgescence and hyperæmia of the cavernous bodies, may be produced by mental impressions, the rose experiments of Dr. John Mackenzie being a striking example. It is also a well-known fact to laryngologists that a transient flushing or blushing of the mucous membrane takes place when the light of the reflector is thrown upon it. The following case is interesting as showing the dependence of a changed condition of the cavernous bodies on a psychical influence. In a patient of the St. Louis Post-Graduate Polyclinic the cavernous tissue of the nose was greatly swollen. I proposed to excise a portion of it. She demurred strongly, and when I insisted, became very much frightened: on looking again, I was astonished to find that the swollen tissue had become much paler, and had been reduced in size fully one-half. This was fully observed by members of the class.

Uterine asthma and peptic asthma, on which so much stress has been laid by Hyde Salter, may also have a possible connection with a certain condition of the upper air-passages. The coincidence of paroxysms of nervous dyspnœa with certain conditions of the uterus and its appendages, is well authenticated; but whether these paroxysms are real attacks of asthma or spells of nervous dyspnœa, in which we find rapid breathing with great intensity of the respiratory sounds, but no asthmatic râles, has not been so conclusively established.

Hyde Salter relates one case, reported by another physician, in which real asthmatic attacks occurred during pregnancy; and Engelmann, of St. Louis, has noted a case in which asthmatic attacks followed a retroflexed position of the uterus, and disappeared with the reposition of the organ; but in this case there is no record of the presence of asthmatic râles. Paroxysmal nervous dyspnœa is quite a frequent accompaniment of a disturbed condition of the nervous system. It is seen in hysteria, neurasthenia, and spinal irritation; it is seen in connection with disorders of the uterus or its appendages, and also in cases of impoverishment of the blood or blood-poisoning. Resembling true asthma in its paroxysmal attacks, it is, however, a distinctly different disorder. The dyspnœa is rather a rapid panting than the labored breathing of asthma; the respiratory sounds are simply intensified normal sounds, and the asthmatic râles are absent.

That asthma occurs at many of the critical periods of female life is certainly true. In regard to pregnancy, I have seen two cases in which the asthma disappeared with conception, and has not since returned.

Both of these patients were asthmatics of long standing. It is in these cases of uterine asthma that we can find often a possible nasal origin for the attacks. The connection between the condition of the cavernous bodies and uterine changes is very marked. Many women at the menstrual epoch have vasomotor catarrh, with great turgescence of the cavernous bodies and the mucous membrane. This condition in itself has been shown to be a sufficient cause for the attack, irrespective of the pathological condition of the uterus. The peptic asthma, on which so much stress is laid by Hyde Salter, may be fully explained by referring the irritation to the larynx. Gastric pharyngitis and gastric laryngitis are recognized forms of throat disease. They are dependent upon functional gastric disturbance, with the production of fermentation and acid secretions. In the peptic asthma quoted by Hyde Salter, the paroxysms occurred during the end of the digestive process, showing that the mere presence of food is not sufficient to cause the attack. The majority of asthmatics are dyspeptics, and it is possible that these cases were subject to a gastric laryngitis, in which the sensitive area of the larynx was involved. A similar condition is found to exist in so-called stomach cough. Although the local seat of irritation seems to be, in the majority of cases, in the upper air-passages, it is probable that a disordered condition of other organs exerts a positive influence in provoking the attack. As this is true in other nerve disorders, as migraine, epilepsy, and neuralgia, it is equally probable in asthma. For example, in a person with a disposition to asthma, the attacks may only attain the degree of the first stage, and give rise to scarcely noticeable symptoms. When, however, an increased irritation is added, as would occur through a disorder of the gastro-enteric canal or uterine disease, this added element would be sufficient to increase the irritation, and the first stage would grow into the second with the appearance of all the well-known asthmatic symptoms. A similar condition is found in neurotic palpitations occurring in a heart weakened by anæmia, where a torpid liver would provoke a disturbance, which, in a normal condition of the secretions, would be absent.

All writers on asthma have noticed the great difference in the severity of the paroxysms not only in different individuals, but even in the same individual at different times. Walsh has even assumed two forms of the disorder, one seemingly dependent on a spasmodic and the other on a paralytic condition of the bronchial muscles. If the asthmatic be closely studied during the paroxysm, we shall find a positive and characteristic connection existing between the severity of the attack and certain physical signs in the lungs. We can clearly divide the paroxysms into three stages, each stage characterized by positive physical signs, and with each stage a certain increasing degree of the severity of the symptom is noted.

The first stage may be called the state of

INSPIRATORY DYSPNŒA.

On examination we find the percussion sound unaltered; on auscultation the *inspiratory sound of the vesicular murmur is replaced by a high-pitched, prolonged blowing sound.* The expiratory sound may be absent or unchanged. This blowing inspiration is evidently *a blowing râle,* and it is caused by a cylindrical narrowing of the lumen of the bronchi, not sufficient to cause the sibilant or whistling râles. It is pathognomonic of the first stage of uncomplicated asthma, and differs from the rough inspiratory murmur of bronchitis or the intensified inspiration of the exaggerated respiration such as is heard in compensatory breathing or in the nervous dyspnœa of hysteria or blood poisoning.

When asthma is complicated with bronchitis, this inspiratory blowing sound loses, in a measure, its distinctive quality and becomes rougher and of lower pitch. When emphysema is present, the blowing quality of the sound is less marked, and it becomes much weakened and in some cases is absent.

The symptoms of the first stage are often slight; at times wanting. In some a slight tightness of the chest is experienced; in others a slight dyspnœa is felt on exertion; a paroxysmal cough most marked in the early morning hours is sometimes the only symptom.

The second stage may be called the stage of

EXPIRATORY DYSPNŒA.

It presents the physical signs usually recognized as characteristic of the asthmatic paroxysm. Percussion gives an increased resonance. On auscultation, a prolonged expiration is heard. Both expiration and inspiration may be covered by the sibilant and sonorous râles. In certain cases small moist râles of a liquid character are heard over limited portions of the chest. The symptoms of the second stage are those usually associated with the asthmatic paroxysms; the sense of oppression, the dyspnœa, and the slow, labored breathing are marked. The thorax heaves with each inspiration and the accessory muscles of respiration are brought into action, the patient is unable to lie down, but sits or moves in a fixed position, with raised shoulders and head projected forward. The face is livid and the alæ nasi dilated.

The third stage may be called the

STAGE OF ORTHOPNŒA.

Percussion gives a deep, drum-like resonance, showing the extreme distention of the vesicles. *On auscultation a short inspiratory whiff is heard, and the expiratory sound is inaudible.* The inspiratory whiff is most apparent over the larger bronchi. The symptoms of the third stage of asthma present a picture of the most supreme distress and agony. The patient stands with the hands resting on some fixed point of support, and the entire energy of the body is given up to the struggle for air. The true respiratory muscles seem to be completely inactive, and breathing is carried on entirely by the accessory muscles of respiration. The thorax is fully distended with little perceptible movement; the face becomes dusky, covered with perspiration—in strong contrast with the cold extremities; a sense of constriction is experienced around the body over the diaphragm.

These three stages are evidently produced by the varying and gradually lessening calibre of the bronchial tubes. In the first stage the calibre of the tubes is not sufficiently narrowed to produce the whistling râles. The inspiratory blowing râle heard in this stage is due to the moderate narrowing of the bronchi. A normal inspiration is the result of atmospheric pressure; the thorax is enlarged by the action of the thoracic muscles and the diaphragm, and the lungs are distended by the atmospheric pressure. The expiration is mainly performed by the lung vesicles. In the first stage the calibre of the bronchi is narrowed, but the walls of the vesicles remain intact and are normal: hence the expiratory sound is normal, but the inspiration assumes the peculiar high-pitched blowing found in this stage. In the second stage portions of the bronchi are narrowed to such a degree that the respiratory sounds assume the form of râles—the sonorous and whistling. The vesicles are distended through imperfect ventilation of the lungs and the energy of the stretched, elastic fibres is impaired. The result of this is a prolonged and labored expiration, in which the expiratory sound is formed by the sonorous and sibilant râles. In the third stage the lumen of the bronchi is reduced to a minute canal. The vesicles are distended to their utmost capacity; the bronchial mucous membrane is greatly swollen, and the diaphragm is either in a state of spasm or fixed and crowded by the over-distended lung. The greater portion of the air within the lung is residual air and there is no current except in the bronchi of larger calibre; aëration is performed slowly by the interchange of gases in this portion of the lung. There is no action of the vesicles or the diaphragm, and no expiration is heard; the inspiratory sound is produced by the passage of air through the glottis and larger bronchi. In some cases we can also see transition periods in which the first stage is verging into the second—shown by the presence of inspiration commencing with a blowing râle and ending in a sibilant; or with a blowing râle on inspiration and a sibilant or sonorous râle on expiration. The transition of the second to the third stage is seen in shortened expiratory râles which disappear completely as it lapses into the full third stage.

These different stages of asthma occur in the same individual at different times, although a certain similarity of type is apt to occur in different individuals. That they are simply stages of the same process, and that the varying physical sounds are all due to a narrowing of the bronchi, are fully proven by the effects of therapeutic efforts. For example, the inhalation of nitrite of amyl, or an application of carbolate of iodine to the larynx, will often instantly change the inspiratory whiff of the third stage to the prolonged expiration with the sibilant and sonorous râles of the second. This change is at once realized by the patient in a loosening of the constriction of the chest, and greater comfort and freedom of breathing. We can also, through the same means, produce a change from the whistling râles of the labored expiration of the second stage to the blowing râles of the first. When the asthmatic is subjected to some additional source of irritation, we find the increased distress of the patient explained by the change from the first to the second stage, or the second to the third. Although the asthmatic paroxysm is essentially due to a bronchial obstruction, we find it quite frequently interchangeable, and at times complicated with spasm of the glottis and spasm of the diaphragm. In one case, of a lady sixty years of age, I have seen a pure asthmatic spasm subside and followed in a few days by a distinct spasm of the glottis, with entire absence of asthmatic breathing; and again, in her next attack, glottic and bronchial spasm were absent, and spasm of the diaphragm was present. At this time a feeling of intense constriction was felt over the diaphragm, and the breathing was almost entirely superior costal, with a complete absence of the asthmatic râles. The sense of constriction in the upper part of the chest seen in the asthmatic, was wanting. In another case I have seen a true asthmatic paroxysm complicated, and at times synchronous, with spasm of the glottis. In this case the asthma disappeared, but the man died suddenly from glottic spasm. These conditions cannot be considered in reality as part of asthma, although often complicating it. They bear the same relation to the asthmatic paroxysm as exists in many other nerve disorders. For example, migraine, epilepsy, neuralgia, and insanity, are all interchangeable with asthma, and in families showing a disposition to nerve disorders they may be found in different individuals. That bronchitis and emphysema ultimately arise as sequelæ of asthma, is clearly probable, as the continued disturbance of the normal condition of the bronchial mucous membrane is apt to produce and incite pathological changes; and the great and frequent disturbance of the elastic fibres of the vesicle can only result in weakening and loss of tone. The right ventricle must also frequently suffer, undergoing dilatation and hypertrophy, as the great distention of the walls of the vesicles must seriously interfere with the normal pulmonary circulation.

The mechanism by which the asthmatic paroxysm is caused, has always been the subject of dispute and controversy. Laennec, followed by Andral, ascribed it to spasm of the circular fibres of the bronchi, causing cylindrical narrowing of these tubes. This may be said to be the prevailing doctrine at the present day, and it has been endorsed by many of the most eminent authorities in medicine; among these may be mentioned the names of C. J. B. Williams, Bergson, Hyde Salter, Trousseau, and Biermer. Rieseisen having demonstrated the existence of the circular fibres of the bronchi, others have sought to prove their capability of contraction under certain stimuli. Longet and Volkmann especially claim to have accomplished this by means of electro-stimulation of the vagus, but this result has not been produced when the experiments have been carried out by others. The theory of bronchial spasm as an element of the asthmatic paroxysm, has been warmly disputed. Budd rejected the idea, and he has been followed by Wintrich, Bamberger, Germain Sée, and others. Duchenne having demonstrated that faradization of the phrenic nerve caused spasm of the diaphragm, was inclined to consider this as an essential element of the paroxysm. In this he was supported by Wintrich and Bamberger. Traube denied the nervous origin of asthma, and ascribed the dyspnœa to the fluctionary hyperæmia of the bronchial mucous membrane. He supposed certain persons to have a certain predisposition to asthma, and that the predisposition consisted in a deficiency of the elastic fibre in the lung, allowing a ready distention of the bloodvessels, and thus allowing a ready swelling of the bronchial mucous membrane. Sanderson ascribes the paroxysm to a dependency on a change in the respiratory function of the vocal cords. He believes this to be an extreme relaxation of the vocal cords during slumber, and a narrowing of the rima glottidis. Beau considers asthma to be a bronchial catarrh with viscid secretions. Leyden ascribes the attack to be due to the presence in the bronchi of a peculiar kind of octahedral crystals produced from white blood-corpuscles, which irritate the pulmonary filaments of the vagus, and provoke the bronchial spasm. Weber considers asthma to be a vasomotor neurosis in which an acute catarrh with a dilatation of the vessels of the bronchial mucous membrane is produced. In this theory he has been followed by Störck, who asserts the existence of tracheal congestion as shown by the laryngoscopic mirror. Lately, Sir Andrew Clark has described a condition of the bronchial mucous membrane simulating the wheals of urticaria on the skin, and has sought to prove this to be a pathological condition of the disorder.

That the theory of spasm of the bronchial muscles is the prevailing one must be admitted, but it stands more in the light of medical tradition than proven fact. The experiments made to prove the contractibility of the bronchial fibres by irritation of the vagus have been conflicting, and the untenability of the theory has been notably disproved, both on clinical and experimental grounds, by Wintrich and Germain

Sée. The fact of the circular fibres being of the unstriped variety, in which the contraction must be slow and gradual, absolutely negatives their coöperation in the sudden and transient narrowing necessary to produce the phenomena of asthma. The office of the bronchial muscles seems more probably to be that of supporting muscles, regulating and supporting the bronchi against atmospheric pressure and undue violence of exertion. The recent experiments of Riegel and Edinger have shown conclusively that irritation of the vagus does not provoke a bronchial spasm, but rather a spasm of the diaphragm; Biermer, the earnest defender of the theory of bronchial contractibility, is forced to say that although stimulation of the vagus may not produce marked contractions of the bronchial muscles, we have not yet found the proper experiments necessary to prove it, and possibly the stimulation must be to the pulmonary sympathetic plexus rather than to the vagus. That spasm of the glottis and spasm of the diaphragm occur in the asthmatic cannot be denied by any one who has made a study of the disorder; the symptoms of those conditions are so marked, and their occurrence so frequent, that they cannot be overlooked; but that they are part of the essential nature of asthma is not true, as we find many cases of asthma in which they are wanting. Spasm of the diaphragm can never produce the mechanical râles always found in asthma, although in certain cases it may play an important part in producing the great distention of lung vesicles seen in the later stage of the disease. The theory of Weber, that the paroxysm is due to vasomotor turgescence or dilatation of the mucous membrane of the bronchi, finds complete support in the clinical picture of asthma: the transient and rapid variations of the physical sounds, the presence of the dry and moist râles, and the acute distention of the lungs seen in pronounced attacks of the disease. This theory, however, is directly contradictory to the acknowledged physiological effect of the drugs which are generally recognized as most useful in allaying the paroxysm; the nitrites, chloral, and morphia are all known as relaxants and anti-spasmodics, and their use could only increase the distress if the dyspnœa was due to a vasomotor dilatation of the vessels of the bronchial mucous membrane. The action of chloral and morphine could be explained by their effect on the nerve-centres; but the efficacy of the nitrites finds here no support. The physiological action of venous blood and carbonic acid on the arterioles and their actual effect in asthma negative the existence of a vasomotor dilatation of the arterioles as a cause of the paroxysm. Ludwig and Severini have shown that venous blood, when circulated for a length of time, causes the vessels to dilate, and that a large amount of carbonic acid in the blood causes a dilatation of the vessels. The natural sequence of an asthmatic paroxysm is extreme venosity of the blood, with an accumulation of carbonic acid through its imperfect aëration. These conditions in reality existing to such an extreme degree in the asthmatic paroxysm, would simply increase the paroxysm if the disturbance were due to vasomotor paralysis of the vessels; whilst, in fact, we find them to be essential elements in the natural cessation of the attack.

In a paper read before the American Laryngological Society, at Detroit, in 1885, I described a condition of the nasal mucous membrane seen in certain patients. This condition is characterized by pallor, swelling, and an œdematous condition of the membrane. When irritated as by the touch of a probe or any other irritant, the swelling is increased and a profuse, thin or watery secretion is poured out. This condition promptly subsides after the inhalation of nitrite of amyl, ether, or the instillation of atropine or morphia; but remains unchanged on the application of cocaine. These cases occurred in persons of a marked nervo-vascular temperament, and in whom functional nerve disturbances were common. The existence of pallor, more or less marked, and a marked œdematous condition of the mucous membrane, distinguish this condition from that ordinarily seen in vasomotor catarrh. In the latter condition there is hyperæmia with dilatation of the vessels; but in the former the pallor completely negatives the idea of a dilated condition of the vessels, and the opposite condition must exist. The action of the drugs indicated in these cases rather a spasm of the arterioles, and I have chosen to consider the disturbance of the nasal membrane to be due to a vasomotor spasm of the arterioles of the membrane. The following case, in which this peculiar condition was the accompaniment of a facial neuralgia, is presented as a perfect type of the condition:

A. M., merchant, florid, stout, about forty-five years of age, was brought to me, complaining of facial neuralgia of the left side and great obstruction in the nostril of that side. He said that this obstruction of the nostril had occurred simultaneously with the attack of the neuralgia; that at times it was so great as completely to close the canal. There was a profuse discharge of a thin, limpid fluid, which was greatly increased on the application of any irritant, such as dust, or the touch of the probe. These same agents also had a marked effect in increasing the swelling of the cavernous tissue. On inspection the right nostril was found normal; the left nostril was almost completely occluded by the pallid membrane of the swollen cavernous bodies, almost as pale as that seen in a corpse. It presented an œdematous, boggy appearance, as if the whole tissue was saturated with secretion, and on any irritation this was poured out in a profuse discharge of a thin, limpid character. This entirely subsided with a subsidence of the facial neuralgia.

A study of these cases led me to surmise that possibly an analogous condition may exist in the mucous membrane of the bronchi during asthmatic attacks. I examined a large number of asthmatics during the paroxysm with the laryngoscope mirror, and found that during the paroxysms the mucous membrane of the pharynx, including the uvula, presented a similar pallid, œdematous appearance; that the membranes of the larynx and trachea appeared paler and more swollen than normal, but not so œdematous as that of the pharynx. When portions of the membrane were inflamed, as is common in asthma, the inflamed area presented more the pale red of an intensely anæmic or phthisical subject than the rosy red of ordinary hyperæmia or inflammation. This is in direct contradiction to the observation of Störck, who claims to have found the larynx and trachea congested during the attack. If these conditions can be seen to exist during the asthmatic paroxysms in the upper air-passages as far as inspection is possible, I think we are fully justifiable in reasoning that an analogous condition exists in the bronchi. The normal functional differences between the mucous membrane of the bronchi and that of the upper air-passages would somewhat change the picture, more especially as the excessive glandular secretions would be greatly diminished in quantity or even wanting. A similar condition to this we find existing in the sympathico-tonica type of migraine (Eulenburg), with vascular spasm and diminished supply of blood in the brain.

I would, then, consider asthma to be a disorder of vascular irritability; that the paroxysm is directly due to a partial occlusion or cylindrical narrowing of the lumen of the bronchi through the swelling of the bronchial mucous membrane; that this swelling is caused by a vasomotor spasm of the arterioles with a saturation of the tissues by the liquor sanguinis; this condition is accompanied by a general high blood pressure.

With this theory we find a complete explanation of all the physical signs of asthma. We see the possibility of the rapid changes of physical signs observed during the paroxysms, and we have in its support the physiological action of all the drugs which experience proves to be of value in allaying the paroxysm—the nitrite of amyl, morphia, chloral, lobelia, and iodide of potash in their action allay the spasm at the same time that they tend to reduce general blood pressure; whilst drugs like the bromides prove of little value in breaking the paroxysms when once in force, although they are serviceable in preventing a recurrence.

ENVIRONMENT IN ITS RELATION TO THE PROGRESS OF BACTERIAL INVASION IN TUBERCULOSIS.

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Though much light has been thrown of late on the etiology of tuberculosis by the labors of Koch, Baumgarten, Weigert, and others, the conditions which lead to tubercular infection are yet shrouded in mystery, and many clinical facts and teachings remain seemingly at variance with the new doctrine. The older clinical medicine on one side points to unhygienic surroundings, malnutrition, struma, defect of anatomical structure, and heredity as the main causes of tubercular disease, while experimental research brings evidence not easily to be thrust aside to support its claim to have discovered in the bacillus tuberculosis the virus which is essential to the production of this fatal class of maladies.

The acknowledged causes of consumption may conveniently be divided into those operating before, and after birth, the former coming under the general heading of heredity, the latter of environment. The problems of heredity are most complex and reach, as yet, far into the domain of hypothesis; but the effect of environment in its relation to bacillary invasion may more readily be subjected to study. So much do certain conditions of air, light, food, and especially habitation influence the etiological history of the development of consumption that a prediction as to the prevalence of the disease in any given locality may often be based on a thorough knowledge of these conditions. Drs. Bowditch and Pepper[1] in this country, and Dr. Buchman[2] in England, have done most valuable work in this direction and the results of their labors alone seem sufficient to establish the fact that environment is a most potent factor in the causation of tuberculosis. What, however, are its relations, if any, to the development and progress of bacillary invasion? To determine how far extremes of environment favor or arrest the progress of germ infection and to what degree they are mutually or independently concerned in the causation of tuberculosis, has been the object of this research and an answer to the three following questions sought.

First. What results ensue when both bacillary infection and unhygienic surroundings are made to coexist in tuberculosis?

Second. Are unhygienic surroundings, when every known precaution has been taken to exclude the bacillus, sufficient of themselves to bring about the disease?

Third. Is bacillary infection invariably progressive in animals placed under the best conditions of environment attainable?

EXPERIMENTS.—Fifteen rabbits were made use of and divided in three lots, each set of animals being placed under conditions best adapted to answer in the results noted the three questions already referred to.

Experiment No. 1. Five rabbits were inoculated in the right lung and in the left side of the neck with five minims of sterilized water in which was suspended a sufficient quantity of a pure culture (third generation) of the tubercle bacillus to render the liquid quite perceptibly turbid.

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[1] New York Medical Journal, Dec. 4, 1886.

[2] Ninth and Tenth Report, Medical Officer, Privy Council, 65–67.

The needle of the Koch's inoculating syringe was inserted subcutaneously on the left side of the neck and in the third intercostal space to a depth of thirty millimetres on the right side. These animals were then confined in a small box and put in a dark cellar. They were thus deprived of light, fresh air, and exercise, and were also stinted in the quantity of food given them while being themselves artificially infected with the tubercle bacillus.

Experiment No. 2. Five healthy rabbits were placed under the following conditions: A fresh hole about ten feet deep was dug in the middle of a field, and the animals having been confined in a small box with high sides but no top, were lowered to the bottom of this pit, the mouth of which was then covered with boards and fresh earth. Through this covering a small trap door was cut which was only opened long enough each day to allow of the food, consisting of a small potato to each rabbit, being thrown to the animals. So damp was the ground at the bottom of this pit that the box in which the rabbits were confined was constantly wet. Thus these animals were deprived of light, fresh air, and exercise, furnished with but a scanty supply of food while breathing a chill and damp atmosphere, though free from disease themselves and removed as far as possible from any accidental source of bacterial infection.

Experiment No. 3. Five rabbits having been inoculated in precisely the same manner as the animals in the first experiment, were at once turned loose on a small island in June, 1886. It would be difficult to imagine conditions better suited to stimulate the vitality of these animals to the highest point than were here provided. They lived all the time in the sunshine and fresh air, and soon acquired the habit of constant motion so common in wild animals. The grass and green shrubs on the island afforded all the fresh food necessary and in addition they were daily provided with an abundant supply of vegetables. Thus, while artificially infected themselves they were placed in the midst of conditions well adapted to stimulate their vital powers to the highest point attainable.

RESULTS.—*Experiment No.* 1. Four of the inoculated rabbits confined in the cellar died within three months: in all of them the injected lung was extensively diseased; the other lung and the bronchial glands being also more or less involved and tubercles in various stages, but sufficiently advanced to be macroscopical, were found in the pleura, peritoneum, spleen, and liver; from these lesions pure cultures of tubercle bacilli were obtained. The fifth rabbit survived and was killed four months after injection; at the autopsy the right lung was found solidified and shrivelled, the upper portion being almost entirely destroyed, while a bronchial gland as large as a hazelnut, filled with creamy pus, occupied the right chest; tubercles, which in many places had become cheesy, studded the upper portion of the left lung. The other organs were healthy.

Experiment No. 2. The five uninoculated and healthy rabbits placed in the damp pit were all living at the end of four months. They were emaciated and their coats were rough, but they still seemed about as active as at the beginning of the experiment. They were all killed within a few days of each other, but a careful examination of their organs revealed nothing abnormal in any of them.

Experiment No. 3. One of the five rabbits which were allowed to run at large died just one month after inoculation. The lower portion of the lung was solidified, the bronchial glands enlarged, as well as the axillary glands on the left side, and a few tubercles were made out in the spleen. The left lung and all the other organs were sound. The four other rabbits remained apparently in perfect health, and so active had they become that two of them could only be captured with the aid of a gun. All four animals were killed at the beginning of November, or four months after inoculation. They were loaded with adipose tissue and their flesh was so firm and red as to be in striking contrast to the blanched and flabby muscles of the other rabbits previously examined. All the organs were healthy and even the points of inoculation could not be made out.

A review of the evidence afforded by these experiments confirms the view that the production of tuberculosis is a most complex problem and one in which many elements besides the bacillus enter. How surely and rapidly this microbe accomplishes its work when the normal resisting power of the system is for any cause lowered, is well shown by the manner in which the first lot of animals succumbed. Localized tuberculosis was in every instance but one quickly followed by general systemic infection and death. That animals kept in most laboratories are frequently confined under conditions of air, light, and overcrowding, which may materially influence the results of investigations in a disease of the nature of tuberculosis, can hardly be denied and should be kept in view.

Necessarily imperfect so far as affording protection from bacillary infection as were the conditions under which the animals in Experiment No. 2 were placed, the results obtained seem to indicate that unfavorable environment and the consequent malnutrition which invariably follows existence amidst unhygienic surroundings are not sufficient of themselves to cause tuberculosis. The fate of the animals allowed to run wild is most instructive, inasmuch as it seems to indicate that in a great majority of instances resistance to the invasion of so deadly a germ as the tubercle bacillus is possible in the artificially produced disease, provided the vital and nutritive processes of the animal are stimulated to the highest possible state of activity.

In estimating, however, the power of environment in rendering these rabbits insusceptible to the disease, it must be remembered that in them the tuberculosis was an artificial one, produced in previously sound animals, and not the culmination, as in the spontaneous disease in man and animals of many debilitating causes, acting often through long periods of time, and impairing the resisting power of the system to such a degree as to allow of spontaneous infection. That incipient phthisis is frequently recovered from is demonstrated by the results of autopsies on individuals dying from other causes, and by a long list of clinical observations. The interesting cases of tubercular inoculation in circumcised children recently reported by Lehman,[1] furnish proof that so large a number as thirty per cent. of recoveries may occur, after artificial inoculation, even when profound systemic infection has existed. Experimental research has already furnished proof of the potency of environment in determining microbic diseases in animals otherwise insusceptible. Thus, Pasteur[2] succeeded in killing hens with anthrax, after reducing their naturally high temperature by keeping them partially immersed in cold water, though these birds in their usual surroundings are proof against this microbe. Gibier[3] gave the same disease to fish, and Metzchinkoff[4] to frogs, by warming the water in which they lived, after failing to infect them in their natural environment. Wild animals and game birds, which, in their wild state, are never known to die of tuberculosis, rapidly succumb to the malady when placed in confinement, and the North American Indians, among whom phthisis is practically unknown while living a savage life, are decimated by consumption when placed under the trying restrictions of a more civilized mode of existence.

If, therefore, environment is so potent a factor in determining bacterial infection, are its effects on the future course of the malady when it has occurred to be disregarded? How potent may be its influence is demonstrated by the widely differing results obtained in the inoculated rabbits allowed to run wild, and those confined amidst unhygienic surroundings. That it is not, however, more than a predisposing cause of the disease, seems indicated by the survival of the animals in Experiment No. 2, which, though they were deprived of fresh air, light, and exercise, and stinted in the amount and quality of their food for over three months, developed no organic lesions. Thus it would seem that the local mischief having been produced, the future type assumed by the morbid processes, and even the ultimate result, is greatly dependent on the resisting power evinced by the individual, which may be computed as the sum total of all the conditions which affect individual vitality through heredity and environment.

The two ultimate elements in this struggle for existence are the bacillus and the cell. Though in its infancy, bacteriology already points to the cell as an active factor in resisting the progress of bacterial invasion. Metzchinkoff[5] saw the lymph cells of the frog englobe and destroy anthrax bacilli, and Wyssokowitsch[6] found the microbes which he injected in the circulation of animals, taken up by the endothelial cells lining the capillaries of various organs, where they finally became destroyed. Suppuration is now being looked upon by some as a conservative process in which the leucocytes are thrown out in great numbers, to destroy bacteria, and as a barrier to systemic infection. The peculiar relation of the bacilli to the nuclei in the giant cells themselves, suggests the possibility of an antagonism between the two. As the pathogenic qualities of infectious germs may in many instances be abrogated or diminished at will, as in the preliminary manipulation of bacteria used in vaccinations, by placing them under peculiar conditions of environment which rob them of their virulence, or modify it, so may the resisting power of their natural enemies, the cells of the body, be diminished or increased by the same means. Watson Cheyne,[1] in a review of some of his recent experiments, after describing the manner in which large quantities of putrefactive and non-pathogenic bacteria are destroyed when injected into the blood-current of rabbits, adds "but this does not occur if the animal is in a bad state of health."

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[1] Deutsch. med. Wochensch., 1886, Nos. 9-13.

[2] Les Bacteries, Cornil and Babes, page 582.

[3] Ibid., page 581.

[4] Virchow's Archiv, vol. xlviii. p. 503.

[5] Virchow's Archiv, vol. xlviii. p 503.

[6] Ueber die Shicksal der ins blut injicerten Mikroörganism. Zeitschrift für Hygiene, Bd. i. Heft 1.

Viewed in this light, the teachings of clinical medicine, the knowledge obtained by a study of the therapeutics of the disease, and the proof offered by experimental research, are in perfect accord. All measures which tend to increase the vitality of the body cells have been found to be precisely those which are most effectual in combating tuberculosis; one by one, specific methods of treatment, which for a season enjoyed popularity, have fallen into disuse, and hygiene, climate, and feeding—in other words, a favorable environment—have alone given results which have stood the test of time.

A consideration of the evidence offered by this study, therefore, teaches that though environment may bear but the relation of a predisposing cause to microbic infection, it is, nevertheless, a potent factor in determining the future type, and even the final results of the disease, and that if we may not under-estimate the pathogenic properties of the bacillus, the effect of extremes of environment on the resisting power of the cells of the body is an element in this complex problem which should not be ignored.

THE PUPIL IN ITS SEMEIOLOGICAL ASPECTS.

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Many observations have been made, from numerous standpoints, regarding pupillary conditions, yet with a few notable exceptions, they have been studied in an isolated manner, relative to the particular disease or lesion of which they might be more or less symptomatic. They have been often looked upon, and are still regarded by some, as curious, interesting, but erratic phenomena, far too variable to be depended upon, and without any connecting thread upon which these conditions, as seen in a variety of diseases, could be strung. Few attempts have been made to grasp pupillary manifestations as a whole, still fewer to reduce the varying phenomena to principles or to reduce the laws by which they are controlled.

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[1] Bacteriology. Amer. Journ. Med. Sci., January, 1887.

Among the papers dealing with the pupil as a whole, that of Dr. Alph. Drouin is one of the most complete, and the writer is indebted to that work for information, especially from the section devoted to anatomy and physiology. Mr. Hutchinson's excellent papers on the "Symptom Significance of Different States of the Pupil," published in the first volume of *Brain*, contain much that is of value, to which the reader's attention is directed.

In the present paper it is intended to give, first, with the view of refreshing the mind of the reader, a brief outline of the physiological phenomena pertaining to the movements of the pupil, and thereafter to present a series of personal observations from which certain conclusions have been drawn.

PHYSIOLOGICAL OUTLINE.—The optic nerves have no direct control over the pupil. The impression produced by light falling upon the retina passes through the second nerves to the corpora quadrigemina, which communicate an impulse to the oculomotor centres, and so cause pupillary contraction. The second is thus the afferent nerve in this reflex (excito-motor) action. This reflex phenomenon may be brought about not only by the impression of light upon the retina, but also by mechanical stimulation of the optic nerves, which induces in them a sensation of light. When both optic nerves are divided or paralyzed, dilatation and immobility of the pupils ensue. Paralysis of one optic nerve produces dilatation of the pupil with blindness on the same side as the lesion; but owing to the preservation of consensual movements the pupil of the injured eye contracts when impressions of light are made upon the sound retina, though these are quicker and stronger on the sound side. Therefore, pupillary phenomena are sometimes wanting when only one optic is paralyzed, owing to the preservation of consensual movements; in this way it differs from unilateral lesions of the third, which always affect the corresponding pupil in a very definite way. Section or destruction of one optic tract produces dilatation of the opposite pupil, and blindness of the opposite eye.

The third nerve takes origin beneath the floor of the aqueduct of Sylvius, and supplies the ciliary muscle and sphincter of the iris, besides all the muscles of the globe with the exception of the external rectus and superior oblique. When the third nerve is stimulated contraction of the pupil on the same side ensues, and when it is divided or paralyzed the pupil dilates; it no longer responds to the action of light, and accommodation is abolished. When the central portion of a cut oculomotor is stimulated, the opposite pupil becomes contracted, provided the nerve on the opposite side remains intact. In mydriasis as a sequent of oculomotor paralysis, the pupil may be made to dilate still further by either stimulating the sympathetic, or by the action of atropine. In man, pathological lesions of the third nerve generally result in mydriasis, though the writer has seen a case of a contracted pupil due to neuritis of the third on the same side; and M. Voisin found in one instance, in the case of a general paralytic who had unequal pupils, one of which was contracted, that there was an effusion of blood into the nucleus of origin of the third on the same side. Besides its action on the pupil, paralysis of the third when complete causes paralytic ptosis, strabismus outward and downward, slight protrusion, and immobility of the eyeball. There is, of course, inability to adduct the eyeball, and consequent double vision. It is well to recollect that paralysis may be confined to individual branches of the nerve. Unilateral affections of the third show themselves in the pupil on the same side as the lesion in the brain. Intracranial unilateral section of the fifth nerve causes on the same side as the lesion, fixity of the eyeball, contraction and immobility of the pupil. The want of sensibility soon leads to inflammation and ultimate destruction of the eyeball. The same pupillary effect is produced on section of the sympathetic, and some suppose that the action of the fifth on the pupil is due to the vasomotor filaments which it contains.

The centre for dilatation of the pupil is situated in the medulla oblongata. Thence the fibres make their exit partly through the trigeminus, partly through the lateral columns of the cord, in the ciliospinal region (from the sixth cervical to the third dorsal vertebræ), passing out by the two lowest cervical and the first two dorsal nerves into the cervical sympathetic. The latter fibres find their way to the iris, not only through the cervical sympathetic, but also by the cavernous plexus, lenticular ganglion, and ciliary nerves. It may be interesting to note, as having a bearing on the question of the power of the vasomotor system on the iris, that Landois and Stirling state that though the vasomotor and oculo-pupillary fibres " lie in the same trunk in the neck they do not issue from the cord by the same nerve roots; the latter come out of the cord with the anterior roots of the first and second dorsal nerves (dog), while section of the cord between the second and fourth dorsal vertebræ produces the vasomotor changes only."[1] It may, however, be difficult to ascertain whether the latter sections produce direct pupillary effects, as the pupil may be influenced by the state of the bloodvessels. More definite information on this point is necessary.

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[1] Ferrier states that in the monkey the second dorsal is the only nerve issuing from the ciliospinal axis which produces dilatation of the pupil on irritation.

When the cervical sympathetic is stimulated, dilatation of the pupil ensues; and when it is divided or paralyzed, the pupil contracts. Similar results follow like causes applied to the medulla, and especially to the ciliospinal zone. Budge describes this as the centre for the dilatation of the pupil, and it may be looked upon as a secondary centre. If it be admitted that there are radiating fibres in the iris, then these are innervated by the sympathetic, causing dilatation of the pupil, while the oculomotor innervates the circular fibres. But Rouget, and many others, do not admit the existence of radiating fibres, explaining the action of the cilio-spinal axis on the pupil as being due solely to its vasomotor control.

When the cervical sympathetic is divided, the vessels of the corresponding side of the head, face, ear, and mucous membrane of the mouth, become dilated; there is sweating on that side of the head, elevation of temperature, the vessels of the iris are engorged with blood, and there is contraction of the pupil. If the peripheral end of the cut sympathetic be electrically stimulated all these phenomena disappear, and the pupil dilates. Many infer from these and other phenomena, that the action of the sympathetic on the pupil is exercised through the intermediary of the bloodvessels.

Unilateral excitation of the cord in the ciliospinal region produces dilatation of the pupil on the same side. Although the ciliospinal zone is specially susceptible to impressions giving rise to pupillary phenomena, yet irritation applied to almost any part of the cord is apt to be followed by dilatation of the pupil. This centre is likewise connected with the afferent sensory nerves, so that painful impressions on the skin and mucous membranes may reflexly produce dilatation of the pupils.

When the corpora quadrigemina are irritated, both pupils contract, and when destroyed, dilatation with immobility of pupils and destruction of sight ensue. It will be observed, that the pupillary effect is similar to that produced by lesions of the third nerve.

Were Longet's observation correct, one could remove from an animal the whole brain, with the exception of the corpora quadrigemina, without producing any pupillary indication. The writer would like to have further evidence on this point before accepting this statement as a fact.[1] Even were it the case, it would, as M. Drouin points out, not be correct to conclude that lesions of the cortical masses have no effect upon the movements of the iris, as various encephalic modifications have distinctive pupillary indications. It is supposed that there are two cortical motor centres for the pupil; the one situated in the base of the first and second frontal convolutions, which, on irritation, causes dilatation of the pupil through the ciliospinal subcentre; the other located in the angular gyrus, connected with the nucleus of the third nerve by means of centrifugal fibres, which, when irritated, causes contraction of the iris with convergent eyes. These two centres in the cortex of the brain, stated to be connected so precisely, the one with the spinal centre, the other with the oculomotor beneath the aqueduct of Sylvius, are not yet definitely established, and in some measure are yet inferential.

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[1] Ferrier states that in animals deprived of their cerebral hemispheres, a flash of light before their eyes will cause the pupils to contract. Judging from this, the pupils must be either medium or dilated in such cases.

In considering the manner in which cerebral lesions may act upon the pupils, it is necessary to weigh the possible participation of the various nerve centres, and the effects of modifications of the brain as a whole upon them, and also the relation of the state of the cerebral circulation to that of the iris.

The phenomena produced by lesions of the cerebellum upon the pupil are varied, generally myosis, occasionally mydriasis; both being accompanied by strabismus.

Meningeal affections may extend so widely that many parts of the brain and basal nerves may be implicated; and probably by reflex sympathetic action, changes may be induced in the eye and iris. When one remembers that the internal carotid supplies both the pia mater and globe of the eye, and that the same vasomotor centre supplies the vascular nerves of those arterial branches, the influence of the meningeal affections over the iris may be understood.

There is considerable divergence of opinion regarding the manner in which certain pupillary movements are brought about, and also as to the exact mechanism controlling these movements. While all admit the existence of the sphincter of the iris, there is no unanimity as to the mode by which dilatation is effected. While some believe that there are muscular radiating fibres whose function it is to dilate the iris, others deny their existence, believing that the dilatation and contraction of accommodation take place in virtue of the inherent elasticity of the iris. Those holding the latter view say, physiology shows that the movements of the iris are controlled in two ways, the one being functional or active, relating to accommodation during the exercise of vision, the other being passive, depending on the variations of the circulation in the encephalon and iris. The former movements are those arising from the impressions of light on the retina communicated through the second nerve to the corpora quadrigemina, which produce contraction of the pupil through the oculomotor acting on the iris. In those functional movements the changes in the pupil are brought about by the elasticity of the iris. The passive or vascular alterations of calibre are quite of a different character, and are independent of visual impressions, though the power of accommodation may remain. In those the movements of the pupil are regulated by the vascular system of the iris, which is in complete harmony with that of the encephalon. Myosis ensues when the vessels of the encephalon and those of the iris are dilated; and dilatation of the pupil corresponds to anæmia of the encephalon and iris. It is in this way that congestion of the brain and its membranes, the result of paralysis of the cervical sympathetic, produces fluxion or paralytic dilatation of the vessels of the iris and contraction of the pupil; while in irritation of the sympathetic, in ischæmia of the brain, due to epilepsy, syncope, strong moral emotions, powerful irritation of the sensory nerves, etc., the vessels of the iris being contracted, mydriasis ensues. Regarding the action the various states of the encephalon might have on the pupils, it is said that one has only to determine what effect the lesions have on the circulation. Prominent among those who have advocated this view is Mosso, of Turin, who declares that the size of the pupil follows exactly the oscillations of the bloodvessels, and M. Drouin warmly espouses the same view, regarding the pupil as the manometer of the cerebral circulation. M. François Frank refutes this theory, and states that the movements of the pupil are quite independent of the condition of the bloodvessels; the evidence he advances in support is far from conclusive.

There is this difference between the influence exerted on the pupil by cerebral affections and those arising from the ciliospinal axis, the former can affect the size of the pupil in two ways: first, through the medium of the bloodvessels, second, by injuring the apparatus controlling the functional movements of the iris (the optic and oculomotor nerves and corpora quadrigemina); while the latter, the ciliospinal, can affect the pupils in only one way, by means of the reflex phenomena determining dilatation and contraction of the vessels.

METHOD OF EXAMINING THE PUPIL.—In examining the pupil, the shape, size, activity, and any difference existing between the two pupils, should be noted. The following rules ought to be attended to. The patient ought to face some source of light, such as a window.

1. Both eyelids ought to be closed, and after the lapse of a few seconds both ought to be simultaneously opened, when the observer should note whether they contract equally.

2. One eyelid should then be closed for half a minute; observe on opening it whether there be immediate contraction in that pupil, and whether simultaneous contraction takes place in the opposite pupil. The same should be repeated in the opposite eye. By this means an amaurotic eye would be detected, as in it the consensual movement persists, while the direct movements are abolished.

Pupilometers. Many pupilometers have been invented, such as those of Olbers, Follin, Fick, Badel, Galezowski, Landolt, Gorham, etc., some of them being ingenious instruments. For practical purposes, however, Hutchinson's idea of the disk of polished steel, with holes punched in it, or the simple narrow white card, having marked on it a series of black dots, measuring from one to nine millimetres, is sufficient. When in use it is placed close to the eye, and the dot which corresponds most to the size of the pupil is noted, and its exact size in millimetres is read off. This has been employed by M. Drouin, and Dr. Finlayson figures it in his work on clinical medicine. The widest dilatation of the iris never exceeds nine millimetres.

Personal Observations on the Pupils.—The data upon which the following remarks are founded are based upon personal experience. The various facts were gleaned and recorded as isolated phenomena. It was only in reviewing and collating these, the conception evolved, that, besides the effect on the pupil of lesions of certain brain and spinal centres and their nerves, there were general cerebral conditions, which were accompanied by definite pupillary phenomena, with sufficient constancy to enable conclusions to be formulated regarding them. When these pupillary states are fenced with proper reservations, they form valuable aids to the diagnosis of some of the general conditions of the brain.

When the function of the brain is temporarily suspended, the pupils are in a state of stabile mydriasis. It matters not what the cause of this suspension of function may be, the pupillary phenomena are identical as long as this condition lasts.

In peripheral injuries, involving large extents of surface, such as the mangling of both thighs by a railway accident, a state of shock is frequently induced, in which, along with complete insensibility and the usual accompanying phenomena, the pupils are widely dilated and fixed. Reaction in such cases is often heralded by an alteration in the pupillary state, the mydriasis giving way somewhat, the pupil at the same time becoming mobile, and soon after, vomiting or other sign of reaction sets in. The same phenomena are seen when shock is induced by blows upon the epigastrium, by severe pain, such as may be occasioned by injury of the testicle, and by powerful mental impressions. Again, when, instead of the injury being peripheral, it is applied to the brain itself, and is of sufficient severity to cause suspension of the cerebral function, the pupils are widely dilated and fixed.

As to this state of central shock or cerebral concussion, writers are at variance with one another concerning the pupillary condition attending it. Some state that the pupils are dilated, others that they are contracted, most that they are variable, while a few state that they are unequal. Hospital surgeons, who make a daily or a less frequent visit to their wards, have few opportunities of seeing uncomplicated cases of concussion of the brain, as in the majority of instances the phenomena attending this condition pass off within a period of hours, and in many before the patient reaches the hospital. As an "interne" in the Royal Infirmary, the writer witnessed a number of such cases, the symptoms in each of these passing off in a few hours; and afterward, while occupying the post of Casualty Surgeon in Glasgow, the writer had the fortune of seeing, and the opportunity of observing to a conclusion, at least twenty well-marked instances. The data thus derived pointed clearly to the conclusion that in uncomplicated cases of concussion the pupils are widely dilated and fixed. One of the earliest indications of recovery from this state is to be found in the pupils, the wide dilatation relaxing somewhat, accompanied by a slight mobility. During the period of rallying the pupil is very variable, and generally more or less contracted. In cases of concussion, which are complicated by brain lesion, such as slight compression, the pupillary phenomena, the result of concussion, remain until the latter state passes off, when the slight compression manifests itself, among other ways, by a pupillary state, such as inequality, contraction, etc.. In this way, concussion may temporarily mask other and more serious, though more limited brain lesions, which may manifest themselves when it has subsided. If these two conditions are not discriminated, the pupillary phenomena of the one may be attributed to that of the other.

In hemorrhage considerable loss of blood may be borne without inducing marked pupillary changes, as long as the blood be not removed from the body so rapidly as to induce syncope. When, however, the amount of blood lost is great, equalling one-seventh of the whole, the cerebral irritability is increased, and is accompanied by myosis. When the depletion is carried much further, so that the amount lost is equal to one-fifth of the whole, the cerebral anæmia is so great as seriously to reduce the functional power of the brain; then the pupils are dilated, and if this depletion be pushed so as to induce syncope, they become widely dilated and fixed. When they are in this condition, it is interesting to note how quickly they undergo change when the cerebral anæmia is dispelled by lowering the head and raising the limbs, so as to empty the latter of their vascular contents, and thereby replenishing the heart and brain. The pupils then become mobile, less dilated, and may fall to medium size, or even become contracted, according to the amount of blood thrown into the cranium. This is quite in accordance with the observation of B. Séquard, who has shown that when an animal is suspended by the hind legs, contraction of the pupil occurs, comparable to that obtained by ablation of the superior cervical ganglia.

Much the same pupillary phenomena are seen during the action of drugs which affect the cerebro-spinal system, even in those which, in the first instance, produce myosis. In such, if the action of the drug be pushed, a stage is arrived at, when the function of the respiratory and cardiac centres is so seriously compromised that the pupils become widely dilated and fixed. This may be illustrated by the action of three drugs, opium, chloroform, and alcohol. When the physiological effect of a large dose of opium is fully established, the pupils are in a state of stabile myosis, and continue so as long as the cardiac and respiratory centres are active. When the dose is sufficiently large this stabile myosis is succeeded by a rapid change to that of stabile mydriasis, indicating that the function of the cerebrum and the medulla has been so dangerously interfered with, that it falls practically into abeyance, the cardiac action continuing for a brief period, partly through the inherent ganglionic cardiac centres, the respiration meanwhile being extremely slow, irregular, and gasping. If energetic measures are not promptly adopted, the life of the patient is measured by minutes. This has been verified by frequent instances. Though a most dangerous symptom, it is not absolutely hopeless, as is illustrated by a case of this kind which fell under the writer's observation, in which the patient was restored by means of artificial respiration continued for two consecutive hours (the stomach having previously been duly washed out). At the termination of an hour and a half, when a pause was made in the artificial respiration, in order to test the condition of that function, there was only one gasp, as if the air had just distended the lungs after their artificial compression. The pulse, at the same time, was a mere thread, difficult to perceive. At the end of another quarter of an hour, feeble, shallow respiratory efforts were made by the patient. The artificial breathing was carried on for a further period of fifteen minutes, during which the lividity of the face and surface of the skin cleared away, and after that the patient was able to breathe without further aid. Patient ultimately recovered, and was alive four years afterward. It was interesting to note that after she had recovered partial sensibility, and when she was able to breathe of her own accord, the pupils returned to the condition of myosis from that of mydriasis, in which they had been during the time that artificial respiration had to be continued; or, in other words, they remained dilated until the function of the brain had partially recovered.

This condition of stabile mydriasis setting in so rapidly, and taking the place of the myosis, shows that the opium has no longer the power of asserting its well-known influence on the pupil in the presence of the suspension of the brain function. The change indicates that death is imminent. The mechanism producing contraction of the pupil in these instances may probably be the congestion of the brain and its membranes, as well as the ocular vessels; and the rapid dilatation of the pupil to the anæmia coincident with the suspension of function.

It is probable that statements made in some text-books, regarding the action of opium, as occasionally causing dilatation of the pupils may be explained in this way. When death ensues after opium-poisoning, the pupils first relax somewhat, and then become medium. From this it will be seen, it is quite erroneous to suppose that the pupils will necessarily be found contracted in the cadaver after death from opium-poisoning. In six instances which have come under personal observation, the pupils were found to measure from four to six millimetres after death, although they measured about two millimetres shortly before death. It is right to remember that the apparent congestion of the internal organs in opium-poisoning may, in part, be due to the great fluidity and dark color of the blood.

The coma arising from alcohol, as was pointed out by me in 1879, may be distinguished from that due to other causes by the fact that when the patient is left lying undisturbed for twenty minutes, the pupils are in a state of myosis, pin-head contraction. If an attempt be then made to arouse the patient by shaking him, or pulling his hair, though he still remain quite comatose, his pupils will slowly dilate, until, if the physical irritation be continued, they become fully dilated. If the patient be then left undisturbed, the pupils remain dilated for a period of variable duration—minutes, as a rule, after which they begin to contract, doing so at a very slow rate until they reach their former dimensions. The time taken for the transition from the fully dilated stage to that of pin-head contraction, is from five to ten minutes, varying according to the intensity of the coma. In some rare cases, where the coma is very intense, the change is completed in less than five minutes. In instances in which the patient is not deeply comatose, the dilatation continues for ten minutes, and then contraction sets in at a very sluggish rate. In persons in whom the alcoholic coma is passing off, and who are merely insensible, and who can be temporarily roused, the dilatation of the pupil once established continues, or it may become smaller, though it does not again attain the same degree of contraction it formerly did. These observations have been subsequently verified in many hundreds of cases. In some uncommon instances of cerebral compression, through apoplexy or other cause, the contracted pupil will be slightly enlarged on stimulation (not full dilatation, as in alcohol), and very soon, in most, immediately thereafter, it will contract to its former size.

But when the dose of alcohol is poisonous, and the patient is about to succumb from its effects, the pupils, after being contracted as above, pass rapidly into complete stabile mydriasis. This is a condition which must be very seldom seen as arising from alcohol, but was once observed by the writer, in the case of a man who had half an hour previously drank off at a draught a quart of strong alcohol (proof strength); the pupils becoming widely dilated and fixed, the patient dying fifty minutes afterward. Here the function of the medulla had become interrupted, and finally suspended, just as in opium-poisoning.

In chloroform narcosis, the same pupillary phenomena are observed during the extreme stages. From personal observations, extending over several hundred carefully recorded cases, it is seen that the pupils are in a very variable state during the preliminary periods, much too variable to permit any rule being formulated regarding them. When, however, reflex action is abolished, except in the cardiac and respiratory centres, the pupils become contracted and fixed. This may be regarded as the safety zone of complete chloroform narcosis. But if the anæsthesia be pushed beyond this stage wide dilatation of the pupils ensues, indicating a suspension of function in the cardiac and respiratory centres. This is a most critical condition, though one by no means necessarily fatal, as by lowering the head and raising the floor of the table, and by promptly carrying out artificial respiration, even while feeble respiratory efforts are being made by the patient, the danger may be, and very frequently has been averted. Given a person free from organic lesion of the nerve centres, heart, or lungs, in whom during chloroform narcosis, stabile mydriasis suddenly occurs as a result of the action of chloroform on the respiratory centres, the patient ought to recover, if artificial respiration coupled with the lowering of the head, be promptly resorted to, and the former efficiently carried out. It is interesting to note in such cases the marked effect produced by elevating the foot of the table, so as suddenly to place the patient's head and thorax at a very low level, the pupils becoming quickly contracted. In this connection, however, it ought to be borne in mind, that one of the earliest indications of a return of reflex action is vomiting, which, as a rule, is accompanied by dilated pupils, the result of cerebral anæmia.

In cases where the functions of the cerebrospinal system, especially of the cardiac and respiratory centres, have already been enfeebled (by organic lesion or otherwise), chloroform acts more powerfully; a few whiffs sufficing to induce complete insensibility, and the administration of an ordinary dose giving rise to an alarming state, which only prompt measures can prevent from becoming fatal. In such cases the pupils very readily pass into wide dilatation with a very small amount of chloroform.

When the function of the brain is suspended by want of oxygenated blood, the pupils are widely dilated and fixed. This may be seen in cases of asphyxia either by poisonous gases or arising from mechanical causes. It was once observed by the writer in two men who had all but succumbed by inhaling coal-gas, emanating from a broken gaspipe in their bedroom; and it is also seen in cases of hanging.

Turning to the effects of pressure exercised upon the brain as a whole, it produces pupillary states varying according to its amount. When it is sufficient to place in abeyance the cerebral function, mydriasis occurs; and when of much less degree, causing only a small area to be involved, it is usually followed by myosis. The following is a typical case, illustrating these points as well as the most carefully planned and skilfully executed experiment could do.

While acting as House Surgeon in the Royal Infirmary, Glasgow, in 1870, the writer had the opportunity of observing the following case:

A well-developed and strongly built man, about twenty-eight years of age, was brought into the Infirmary in an unconscious state, having fallen from a height about an hour previously. There were bruises on his face, nose, and forehead, and there was slight oozing of blood from both nostrils. He was deeply comatose, his breathing was stertorous, his pulse slow and feeble, and the pupils of both eyes were widely dilated and fixed. Urine and feces had been passed involuntarily. This state continued for fully half an hour after admission, during which his pulse became so feeble, as sometimes to be scarcely perceptible; his breathing was even more deeply stertorous, and it was accompanied by lividity of the face. At the expiration of this period, a sudden gush of blood from both nostrils poured forth as a torrent, causing wide distention of the nasal alæ. This continued for full two minutes, then quickly lessened in quantity, becoming a mere trickling, which lasted half an hour. The pupils, which had been widely dilated and fixed from the time of his admission into the hospital up to the very moment when the blood began to escape in such volumes from both nostrils, were found at the expiration of two minutes, during which it flowed, to have become medium, to be quite active, readily contracting when exposed to light, and quickly dilating when shaded. Along with this, the lividity of the face disappeared, the breathing became free, though the pulse was extremely weak, and the patient pale. He however soon recovered consciousness, answered a number of questions correctly, and expressed surprise at finding himself in the infirmary. He also remembered, and was able to describe some of the circumstances connected with the accident which caused his injuries. This stage lasted two hours, the pulse and color of the face steadily improved, and during the whole time the pupils were active and normal. Half an hour later, the pupils began to be sluggish and contracted. Three hours after the hemorrhage they were very sluggish and contracted. Four hours later, they did not respond to light, though they were not so contracted as they had been half an hour previously. Patient no longer answered questions, but still was sensible to external impressions, especially of a painful kind. Six hours after the hemorrhage the patient was deeply comatose, and otherwise much in the same condition as when admitted, his pupils having again become widely dilated and fixed. Ten hours subsequently to the hemorrhage (ten and a half hours from admission) breathing became very labored, the lividity of the face marked, pulse flickering, and death ensued about twelve hours and twenty minutes after the hemorrhage from the nose.

The post-mortem examination showed that the cribriform plate of the ethmoid was extensively fractured, the aperture between the fractured bones being filled with clot; the crista gallæ was driven upward, the anterior part of the longitudinal sinus was ruptured, and a clot of blood existed between the dura mater and the skull, filling the greater part of the anterior fossæ, and pushing backward the brain. Both frontal lobes were much compressed, the convolutions were flattened, and the brain tissue comprising them was somewhat softened. The brain, as a whole, bore evidence of compression, but it was otherwise healthy. With the exception of a fracture of both bones of the leg, there were no other injuries.

Remarks.—This case may be divided into four periods, each being accompanied by a peculiar pupillary condition. First, there was a period of severe intracranial pressure, indicated by symptoms of cerebral compression, in which the brain function was for the most part suspended. The pupils at this stage were widely dilated and fixed. This condition was present at the time of patient's admission, and half an hour afterward ended abruptly on the escape of blood from the interior of the skull. Second, with the relief of the intracranial pressure, the indications of compression of the brain disappeared, its functions returned, the patient regaining consciousness. The pupils then became normal, responding actively to the alternate action of light and shade. This state was the immediate sequence of the relief of the pressure on the brain by the escape of the pent-up blood, and it continued for two hours, until after the period of reaction had set in. Third, there was a period of slight cerebral pressure, due to the recurrence of hemorrhage within the skull, occurring shortly after reaction had set in. This was the direct result of the reaccumulation of blood within the skull, and the consequent pressure on the brain, a clot having filled the aperture in the fractured ethmoid. The patient in this stage had become drowsy. The pupils gradually lost their activity, becoming very sluggish and somewhat later contracted. This period lasted about four or five hours. It corresponded to slight cerebral pressure. Fourth, a stage of severe intracranial pressure ensued, marked by all the symptoms of cerebral compression and accompanied by widely dilated and fixed pupils. This lasted about four and a half hours, ending in death. This corresponded to the first stage on admission, the function of the brain having again become suspended. In a tabulated form it would appear thus:

Pressure.	*Action on Brain.*	*Effect on Pupil.*
1. Very severe.	Function almost in abeyance.	Stabile mydriasis.
2. Removal of pressure.	Restoration of function.	Normal and active.
3. Slight.	Interruption of function.	Contracted and sluggish.
4. Very severe.	Suspension of function, ending in its abolition.	Stabile mydriasis.

The same pupillary phenomena arising from pressure, induced by a pathological cause, are illustrated by a case of tubercular meningitis with its accompanying effusion, which is given elsewhere in detail. On admission, the patient, who was insensible, gave vent to the peculiar "hydrocephalic cry." She could move her limbs freely, her pupils were in a state of myosis (stabile). At this stage, it was probable that she suffered from interference with cerebral function, caused by effusion of fluid exercising a degree of pressure on the brain. A few days subsequently, she became unconscious, pulse very feeble, respiration labored and shallow accompanied by great lividity of the face, and a markedly subnormal temperature. The pupils were then in a state of stabile mydriasis. It was diagnosticated that the fluid had further increased, and was now exercising very severe pressure on the brain, placing its function in abeyance, with the exception, perhaps, of the respiratory and cardiac centres, which, though seriously interfered with, were still able to act to a slight extent. To relieve this pressure, a puncture was made through the brain membranes, when a large quantity of cerebrospinal fluid escaped in a jet. While the fluid flowed away, the respirations improved, the cardiac impulse increased in strength, the lividity disappeared, the pupils became much smaller, and shortly afterward became normal in size and sensitive to light, though they were somewhat sluggish. This condition continued for twenty-four hours, the temperature increasing from subnormal to 102.8° F. Ultimately the patient died.

The condition may be thus formulated:

Pressure.	*Action on Brain.*	*Effect on Pupil.*
1. Slight.	Interference with function.	Myosis.
2. Severe.	Function in abeyance.	Stabile mydriasis.
3. Removal of pressure.	Function nearly quite restored.	Mobile and almost normal.

Twelve cases of obliteration of function from pressure and bruising of the brain. Numerous instances of severe injury to the cranial contents have been observed by the writer in which both pupils were widely dilated and fixed; post-mortem examination afterward showing extensive destruction of the cerebral substance. In twelve such cases the patients died within a few hours after the accident. The post-mortem in these showed, besides serious injury of the skull, that both cerebral hemispheres had been encroached upon by extensive extravasations of blood, or by portions of bone or foreign matter driven into the cerebral substance, exercising severe and general pressure and producing extensive laceration of the brain. In all of them there was destruction of both hemispheres, sufficient to obliterate function.

Four cases of extensive bruising and laceration of the brain without pressure. Besides these, there were four cases in which a sufficient hiatus had been formed in the osseous walls of the skull to prevent the possibility of pressure being exercised on the hemispheres, and yet the pupils were dilated; the extensive laceration and severe bruising of the brain having destroyed the function of the part. Nor is the widely dilated and fixed pupils arising from cerebral pressure limited to surface lesions, or such as are caused by traumatism. In cases of extensive hemorrhage from the basal or deep cerebral arteries, causing great pressure or laceration of the brain, widely dilated and fixed pupils are seen, and they are accompanied by abolition of cerebral function. In one instance of this kind which came under personal observation, the lateral ventricles had become greatly distended with blood, the coma was profound, and both pupils were in a state of stabile mydriasis, this being the usual condition of the pupils in such lesions. In another instance, a large cerebral abscess had burst into the ventricles and this was notified by the sudden accession of deep coma, accompanied by widely dilated and fixed pupils. These phenomena are in accordance with those observed by others, who have pointed out that congestion of the membranes and slight hemorrhage into the ventricles is accompanied by contraction of the pupils, while profuse hemorrhage into the ventricles produces dilatation of the pupils. In the latter case, it is supposed that the result ensues from compression of the common motors, but the pressure no doubt causes suspension of function of the brain as a whole.[1]

It is true that cerebellar hemorrhage is generally indicated by contracted pupils, but this is not always so. When the pupils are contracted the extravasation is slight, but when the outpouring of blood is much greater, then dilatation ensues. It is not often that dilatation is seen from hemorrhage into this seat, on account of the great importance of the structures in the immediate vicinity, a comparatively small lesion producing a fatal result.

Both pupils dilated and fixed from very large unilateral lesions. In other instances both pupils were dilated and fixed, the lesion being unilateral, though indirectly the opposite side of the brain was implicated. Six cases of this kind were observed. All of them had sustained fracture through the middle fossa with rupture of the middle meningeal artery or one of its branches, from which extensive unilateral extravasation of blood had taken place. In a general way, these fractures may be described as extending from the base to above the level of the parietal protuberance, and the extravasated blood from the base of the anterior fossa to the posterior part of the middle fossa. The pressure was greatest opposite the middle lobe, the prominences of the convolutions being there effaced, and the outer wall of the lateral ventricles being flattened. In at least three of these the opposite hemisphere was involved directly by the pressure which was communicated through the falx cerebri, a slight concavity on the inner side of the opposite cerebrum indicating the seat of pressure. The opposite hemisphere, from the one flattened by direct contact with the blood clot, would likewise have been affected by the increased amount of cerebro-spinal fluid displaced by the blood clot from the other hemisphere, though the pressure from this cause could not be great, distributed as it would be over the whole cerebro-spinal axis. In these instances the patients survived the injury by only a few hours, during which they were plunged in profound coma, and therefore it is possible that the dilatation of the pupil on the side opposite the lesion might have resulted from suppression of brain function (concussion) on that side; though it is probable that the pressure communicated from the lesion in itself exercised a powerful action. It is further possible that the ablation of function by pressure of the white fibres of the centre of the hemisphere would in itself have produced the paralytic mydriasis of the opposite side, though this is much more prone to occur when the blood is extravasated into the interior of the brain.

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[1] M. Jordan states that "dilatation and total immobility of the pupils on the approach of a lighted candle is one proof of great engorgement of the brain in apoplexy." Dict. des Sc. Méd., 1878.

One pupil dilated and fixed, the other contracted, accompanied by lesions on both hemispheres. A few instances occurred in which, with lesions on both sides of the brain, one pupil was in a state of extreme dilatation with fixity, the other was contracted and fixed. In the first instance of this kind, there was a clot weighing not quite half an ounce on the external surface of the dura mater, over the right hemisphere, opposite the anterior ascending convolution, while there was extensive laceration of the middle lobe of the left hemisphere, with its accompanying extravasation of blood. The patient was insensible, and lived for eighteen hours. The left pupil was widely dilated and fixed, the right was contracted and fixed. The function of the left hemisphere had been abolished, while that of the right had only been partially interfered with. In the second instance there was slight laceration of the cortical substance, principally on the base of the first and second left frontal convolutions, with its accompanying extravasation; while on the right side there was an extensive blood clot which filled the subdural space, the dura mater having been ruptured by a spiculum of bone which had penetrated a branch of the middle meningeal. The patient was insensible, surviving the accident by only four hours. During life the right pupil was dilated, and the left was contracted, both being fixed. In the third case there was an extra-dural clot of blood weighing three ounces, situated principally over the outer portion of the left middle fossa; while on the right side, at the junction of the parietal with the occipital bone, near the vertex, there was a small depressed fracture, an osseous spiculum having penetrated the dura mater. This patient was insensible, and lived about forty-eight hours afterward. He had other bodily injuries of a severe kind, which, however, did not exercise any material effect on the brain-function. The right pupil was slightly contracted and very sluggish, while the left was dilated and fixed. In the fourth, there was a very thin diffuse layer of blood spread over the surface of the pia mater covering the convolutions in the anterior portion of the middle lobe of the left hemisphere; while on the right hemisphere there was an extensive laceration and extravasation into its middle and posterior lobes.

Patient lived a few hours after the accident, during which he was insensible. The right pupil was dilated and fixed, while the left was slightly contracted and sluggish. Some would ascribe these results to irritation and paralysis respectively of the oculomotor; while others would look upon them as due to vascular changes in connection with the cerebral lesions.

One pupil dilated and fixed, the other normal. Many instances have been observed of dilatation and fixity of one pupil, while its fellow, perhaps with the exception of a little sluggishness of movement, remained normal. These were all cases of fracture of the middle fossa of the skull, and in comparatively few of them was the diagnosis verified by post-mortem examination, though little doubt could exist as to the lesion when accompanied, as they were, by the usual phenomena of hemorrhage from the ear, followed by discharge of cerebro-spinal fluid, ptosis, occasionally external strabismus, facial hemiplegia, and paralysis of members. In such the patient was generally insensible at the outset when both pupils were dilated and fixed. As the patient recovered consciousness, one pupil became normal while the other remained dilated and fixed, this being on the side of the lesion. In some of these the visual power on the same side as the dilated pupil was in abeyence; in others, it was imperfect, and in a few it was almost normal. The pressure exercised by the blood-clot must have been sufficiently great to place in abeyance the function of the greater part of the affected hemisphere, as evidenced by the complete paralysis of the opposite member, the interference with vision, and the evident effect upon the third nerve. In those cases in which post-mortem examinations were obtained, the basal fracture was continued into or toward the vertex, and the clot in most instances occupied the whole of the middle fossa from the petrous portion of the temporal to the vertex, the convolutions, especially the ascending, being considerably compressed. The opposite hemisphere was in almost a normal condition. In those that recovered, the dilatation gave way slowly, and was followed by a degree of contraction along with sluggishness of movement which ultimately passed off; though in one case it still remained small and sluggish at the termination of the fifth month from the date of the accident. These changes were evidently determined by the gradual absorption of the blood-clot. It is more than likely that in most of them the third as well as the seventh nerve was paralyzed, and in one or two instances the fifth in addition, as indicated by the loss of sensation on the affected side. Occasionally the second was interfered with. Hearing was generally much affected, if not absolutely in abeyance on the affected side, during the early months, mechanical obstruction by blood-clot producing loss of hearing as well as interference with the nerve.

Pupil contracted on only one side. Quite a number of cases have been observed by the writer in which, while one pupil was normal, its fellow was contracted and fixed, and where, judging from other symptoms, a cerebral cortical lesion was diagnosticated as existing on the same side as the affected pupil. In at least three of these instances the diagnosis was verified by demonstration of the lesion on the operating table, and by the fact that its removal was followed either by great amelioration of the state of contraction, or by its complete relief. One was a case of fibrous tumor of the dura mater, situated over the left anterior lobe, which exercised pressure on the surface of the first and second frontal convolutions. The pupil on the same side as the lesion was minutely contracted and fixed. Operation was demanded for epileptoid seizures. The tumor was removed, and the patient recovered. The activity of the pupil very soon returned, and the contraction was in great measure removed within a few days subsequent to the operation. Ultimately the two pupils acted alike. The second was a case in which there was a cortical extravasation of blood from a bruise of the ascending frontal convolution, and which was surrounded by an area of irritation. The pupil on the same side was contracted and fixed. The lesion was removed by operation. The patient recovered, and the contraction, though at first remaining to a slight extent, disappeared completely within a month. In the third instance, the dura mater over the right frontal region was punctured by an osseous spiculum. The pupil of the corresponding side was minutely contracted. On the removal of the fragment of bone, and the escape of a small quantity of fluid blood from under the dura mater, the contraction of the pupillary sphincter relaxed immediately. Four hours afterward the pupil responded slowly to alternate light and shade. Two days after operation it was quite normal. There are many explanations advanced for such pupillary effects arising from these lesions. The influence of the dura mater on the basal nerves has to be borne in mind, especially when it is inflamed; also that of the possible effect which might be transmitted through the fibres of origin of the optic to its centre, and so to the third nerve; and, again, the effects of irritation arising from pressure exercised on the two alleged centres of pupillary movement in the cerebral cortex. All of them could, however, be more directly explained by vascular changes accompanying these lesions producing their effects upon the vessels of the eyeball.

It is interesting to note that in cerebral softening the action is like that of hemorrhage into the brain, producing abolition of function and dilatation of the pupil. In some such cases there is no doubt that the oculomotor nerve has also lost its power, as indicated by the loss of ocular movement; but in others the movements are retained, the pupil, however, being dilated.

The effects of spinal lesions on the pupil. There have been very many instances under personal observation of spinal irritation inducing labile mydriasis, and there have been a few of complete lesion of the cord causing stabile myosis. Of the latter, one occurred in a man of fifty years, the subject of a sarcoma involving the bodies of the lower cervical vertebræ pressing upon the spinal cord and ultimately crushing it. The pupils were about two millimetres in diameter, and fixed. The vessels of the head and face were dilated, and the conjunctivæ were suffused. One was a child, aged five years, affected with tubercular infiltration and destruction of the bodies of the third, fourth, and fifth cervical vertebræ, opening up the canal and exposing its contents. An abscess formed, which involved a limited area of the spinal canal opposite the affected vertebræ. The anterior portion of the theca was represented by a fungated process of granulation tissue; the cord was in a much softened condition, and was surrounded with pus. The pupils, which for months had been in a state of labile mydriasis, became, during some days prior to death, contracted to two and a half millimetres in diameter. Several traumatic lesions of the cord in the upper dorsal and lower cervical vertebræ have been observed, accompanied by myosis, the contraction being from two to three millimetres. In each of those death ensued within some hours or days from date of injury. In all there was destruction of the cord at the seat of injury; in some, to the extent of severance of almost its entire calibre.

In the foregoing there is sufficient evidence to show that the suspension or abolition of cerebral function in the living body is attended by mydriasis, the latter being the sequent of the former. If inquiry be made concerning the mechanism inducing this pupillary effect coincident with the arrest of cerebral function, the theory which explains the greater part, if not the whole of the phenomena, is that which has been so ably advocated by Mosso. The passive movements of the pupil are regulated by the vascular system of the iris, which is in complete harmony with that of the encephalon. In those conditions inducing general suspension of the cerebral function, a state of ischemia prevails in the brain and iris inducing mydriasis. This, likewise, obtains in unilateral lesions, where the pressure is so great as to induce anæmia of brain and iris. Myosis may also be brought about by a like mechanism acting in the opposite direction. The "irritation" setting up congestion of the cerebral and meningeal vessels, leads to congestion of the vessels of the iris, and so produces contraction of the pupil.

When investigating the cause of a given pupillary state, this should be done in a methodical manner, examining the various sources controlling pupillary movements, and eliminating those which do not apply. The examination ought to be conducted by answering, *seriatim*, the following questions:

1st. Is the pupillary condition due to the local or constitutional action of any drug?

2d. Is the state of the pupil dependent upon any local ocular lesion or optical defect (including artificial eyes)?

3d. Is it due to any spinal or sympathetic lesion, more especially of the cilio-spinal region and the cervical sympathetic?

4th. Is it dependent upon any localized cerebral lesion affecting special brain centres—*i. e.*, corpora quadrigemina, optic thalamus, or the origin and intracranial course of the second, third, and fifth nerves, especially the third?

5th. If due to none of the above, the probability is that it depends upon either a suspension of brain function or to some cerebral "irritation," in either case inducing vascular changes in the encephalon and iris.

The following points, among others, may be formulated from the foregoing:

(A) 1. When the function of the brain is in abeyance, the pupils are in a state of stabile mydriasis.

2. This may arise either from temporary suspension or from abolition of function.

3. Temporary suspension is illustrated by shock, and the effect of some poisons; while the abolition of function is exemplified by extensive laceration and compression of the brain.

(B) 4. When the function of the brain is interfered with by conditions usually included under the term "irritation," the pupils are in a state of myosis; sometimes labile, but generally stabile myosis.

5. This "irritation" or interruption of function may be seen during certain degrees of cerebral anæmia, produced experimentally, and not as a pathological result; certain amounts of brain pressure, and certain stages of intracranial inflammation.

6. These are illustrated in persons who have suddenly lost a considerable quantity of blood (about a fifth of the whole); in the growth of intracranial tumors and the formation of sanguinolent serous and purulent effusions, when the degree of pressure may be denominated as "medium," and at certain periods of meningitis and encephalitis.

(C) 7. The same pathological factors which cause myosis may also cause mydriasis, the degree in which these factors are present being the determining point between the former and the latter, and not *merely* the particular locus in the brain.

8. It is well illustrated by cases where the hemorrhage is repeated, and is finally pushed to syncope; in intracranial pressure, which is gradually increased until it becomes great, such as arises from tumors, blood clots, and inflammatory products.

(D) 9. When the function of one-half of the cerebrum is placed in abeyance by a superficial or cortical lesion, the pupil on the same side as the lesion is in a state of stabile mydriasis.

10. This is well illustrated in cases of intracranial sanguinolent effusion consequent on injury (see list of cases).

(E) 11. When the function of one-half of the cerebrum is interfered with by some source of cortical irritation, the pupil on the corresponding side to the lesion is in a state of myosis.

12. This is illustrated by traumatic and pathological lesions affecting the cortex of the cerebrum (see list of cases).

(F) 13. Hemorrhage into the pons Varolii when small, causes strongly contracted pupils; but when it is more extensive, involving the gray matter beneath the aqueduct of Sylvius, a state of stabile mydriasis is induced.

14. Effusions into the lateral ventricles when small, produce contraction of the pupils, but when the effusion is great stabile mydriasis ensues.

15. Inequality of the pupils indicates a unilateral lesion or lesions.

16. When the lesion is cortical and unilateral the pupillary manifestations are on the corresponding side. When the basal nerves are affected unilaterally the pupillary effect is manifested on the same side as the lesion. When the lesion is unilateral and affects the function of the white fibres of the cerebrum the opposite pupil is generally affected. When the basal ganglia are implicated unilaterally the pupil is sometimes affected on the same side as the lesion, occasionally on the other side.

In a case of cholesteatoma and in another of glioma of the right optic thalamus, dilatation of the left pupil was found (*Ross*, vol. ii. p. 572).

In lesions of the cerebral peduncles the pupil is affected on the same side as the lesion.

Lesions in the corpora quadrigemina affect both pupils, irritation[1] causing contraction, destruction causing dilatation and immobility.

Section or destruction of one optic tract, causes dilatation of the opposite pupil and blindness of the opposite eye.

17. Irritation of the cord, especially the cilio-spinal axis, produces dilatation of the pupils, while destruction of the cord causes contraction. These effects are generally seen in both pupils, though, experimentally at least, they may be confined to the same side as the lesion.

18. The pupils are affected in the same way by lesions of the sympathetic, though in unilateral lesions it is only the pupil on the same side as the lesion which is affected.

19. Speaking generally, when myosis is due to a cerebral cause, it indicates the earlier stages of various affections; when due to a spinal

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[1] Unilateral electrical stimulation causes dilatation of both pupils, the opposite one becoming first dilated. Ferrier explains this as the result of irritation of a sensory structure, in this case acting through the medium of the anterior roots of the second dorsal nerves which ascend in the cervical sympathetic.

lesion, it points to a most serious paralysis, often to the destruction of the part. When mydriasis arises from a cerebral lesion it is generally present in large amount; when due to a spinal affection it indicates irritation of the part.

MYOSIS OCCURS UNDER THE FOLLOWING CONDITIONS:

1. When a bright light acts upon the retina.

2. Accommodation for a near object.

3. Rotation of the eyeball inward.

4. Local irritation or painful affections of the eyeball.

5. Irritation of the oculomotor nerve.

6. Paralysis of sympathetic roots of lenticular ganglion or trunk of sympathetic in the neck. In paralysis of the fifth there is myosis and inflammation passing on to destruction of the eyeball.

7. Paralysis of the ciliospinal region of spinal cord. All affections which destroy the cervical spinal marrow and intercept its conductibility produce congestion of the face and contraction of the pupils. In neurosis, which suspends or diminishes the tone of the sympathetic or spinal axis.

8. Encephalic congestion, such as: obstacle to return of blood in jugulars; venous congestion due to cardiac causes; active hyperæmia, plethora, fevers, pneumonia, hepatitis, etc.; when animal is suspended by the heels; in early stages of meningitis and encephalitis; in acute mania with marked activity of the cerebral circulation; in chronic mania pupils are variable, when contracted are said to indicate supervention of paralytic dementia.

9. During sleep; some believe this to be due to the congestion of the cerebral vessels and those of the iris (Mosso); others, to the inward rotation of the eyeball.

10. In the early stages of cerebral tumor.

11. In small hemorrhages into the cerebellum. In irritation of the cerebellum, contraction of the pupil on same side as lesion ensues.

12. Electrical stimulation of the angular gyrus frequently causes contraction of the pupil.

13. During forced expiration, when the eye is at the same time passive. Also generally seen during the period of apnœa in Cheyne-Stokes respiration.

14. Convulsions arising from meningo-encephalitis are said to be accompanied by myosis, while in convulsions due to epilepsy and in epileptiform fits they are usually accompanied by mydriasis.

15. When the eye contracts on accommodation to a near object, yet does not contract to light, this indicates a lesion situated between the corpora quadrigemina and the oculomotorius. This affection is known as the Argyle-Robertson symptom. It is seen in locomotor ataxia and occurs in the progressive paralysis of the insane.

16. During uræmic coma.

17. Myotics: physostigmine, nicotine, pilocarpine, morphine, muscarine.

MYDRIASIS OCCURS UNDER THE FOLLOWING CONDITIONS:

1. In darkness or in subdued light.
2. Accommodation for distant objects.
3. Rotation of the eyeball outward.
4. In forced movements discharged from the medulla: vomiting, swallowing, chewing, forced respiration.
5. Paralysis of the oculomotor (accompanied or not by immobility of eyeball, external strabismus, diplopia, etc.).
6. Destruction of the optic: amaurosis. When unilateral, associated movements continue.
7. Irritation of sympathetic: powerful impressions on sensory nerves; strong moral emotions, mental pain, grief, fear; neuralgia of the fifth nerve.
8. Irritation of the spinal cord, especially ciliospinal region.
9. Encephalic anæmia: In all cases where there is reflex contraction of the vessels of the head; when loss of blood from the body is excessive; obstruction of the carotid arteries; in thrombosis of brain sinuses; dilatation of mesenteric vessels when extreme; syncope, intense cold, rigors; dyscrasias of the blood, convalescence, cachectic conditions; asphyxia, epilepsy, in certain stages of these affections.
10. Pressure of cerebrum when great in amount, as from hemorrhage, neoplasms, etc. In the last stages of meningo-encephalitis.
11. In cerebral softening. In acute dementia (œdema of cortex cerebri) observers state that the pupils are invariably dilated (Hutchinson).
12. In idiots the pupils are generally dilated.
13. During deep inspiration, generally in respiratory period of Cheyne-Stokes breathing.
14. Hemorrhage into centrum ovale and into cerebral peduncles.
15. Ferrier produced dilatation of opposite pupil by destructive lesion of the optic tract in the thalamus, indicative of rupture of the centripetal fibres to the irido-motor nucleus in the floor of the Sylvian aqueduct.
16. In hydrophobia there is mydriasis.
17. Mydriatics: atropine, homatropine, duboisine, daturine, hyoscyamine. Curare injected subcutaneously in animals (five to ten centigrammes) induces in one or two hours complete paralysis of the third nerve.

THE EFFECT ON THE PUPIL OF LOCAL CONDITIONS OF THE EYEBALL:[1]

1. Hyperæmia of the iris produces contraction of the pupil which darkness scarcely diminishes.

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[1] The writer is indebted to Dr. Thomas Reid for revising this list of pupillary effects occasioned by local conditions of the eyeball.

2. Presbyopia and hypermetropia cause contraction of the pupils in cases where continuous and excessive strain for near accommodation has been long continued and has produced asthenopia.

3. Pupillary atresia, consequent upon chronic irritation with posterior synechia, producing contraction of the pupil.

4. In synechia total dilatation is impossible, the iris only dilating where free, hence, the pupil is irregular. If the synechia is annular the pupil is both contracted and immobile.

5. In microria there is a congenital state of extreme contraction.

6. In glaucoma the pupil is dilated, contracting little or not at all to the action of calabar bean.

7. In coloboma, both in the congenital form and after iridectomy, there are irregularity and immobility of the pupil.

8. In idiopathic mydriasis there is little contraction to the action of light or to myotics.

9. In certain cases of amblyopia and amaurosis there is dilatation of the pupil.

10. In hippus pupillæ there are alternate contraction and dilatation often accompanied by nystagmus.

11. Inequality of the pupils exists in some who have different degrees of refraction in the two eyes, one being emmetropic and the other myopic.

THE THERMAL DEATH-POINT OF PATHOGENIC ORGANISMS.

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An exact knowledge of the thermal death-point of pathogenic organisms is desirable, both as a matter of general scientific interest, and from a practical point of view. As biologists, we wish to know whether the vital properties of the living protoplasm contained in the minute vegetable organisms in question are destroyed at a uniform temperature, and if so at what temperature; or whether there is a considerable range in the limits of vital resistance to heat exhibited by different organisms of this class. As sanitarians, we wish to know what temperature can be relied upon for the destruction of disease germs in the excreta of patients suffering from typhoid fever, from cholera, and from other infectious diseases transmitted by means of the alvine discharges of the sick; whether boiling of infected clothing, or of drinking water contaminated with disease germs, is a safe means of disinfection, etc.

Various experimenters have recorded observations with reference to the thermal death-point of different microörganisms, but, so far as I know, no one has heretofore made an extended inquiry, by means of a uniform method, with a view to determining the vital resistance to heat of the considerable number of pathogenic organisms now known to bacteriologists.

All of the experiments recorded in the present paper relate to *moist heat*—that is to say, the test-organisms have in every case been in a moist condition, in fluid cultures. The effect of dry heat upon desiccated organisms is quite another question. This has been studied by Koch and Wolffhügel,[1] who have summarized the results of their experimental work as follows:

> "1. A temperature of 100° C. (212° F.), maintained for one hour and a half, will destroy bacteria which do not contain spores.
>
> "2. Spores of mould-fungi require for their destruction in hot air a temperature of from 110°–115° C. (230–239° F.), maintained for one hour and a half.
>
> "3. Bacillus spores require for their destruction in hot air a temperature of 140° C. (284° F.), maintained for three hours." (Op. cit., p. 231.)

In my experiments I have adopted ten minutes as the standard time of exposure to a given degree of temperature.

A fresh culture of the organism to be tested is introduced into capillary glass tubes which have an expanded extremity to serve as an air chamber, by means of which the culture fluid is drawn into or forced out of the capillary tube. This is readily accomplished by heating the little bulb.

The glass tubes, hermetically sealed, are introduced into a vessel containing water, which is kept at a uniform temperature by personal supervision, a Bunsen burner being the source of heat. A standard thermometer is placed in the vessel, and this and the capillary tubes are protected from the bottom of the vessel containing them by a thick plate of glass. A uniform temperature throughout the fluid is maintained by stirring it with a glass rod.

After exposure for ten minutes to a given temperature the sealed extremity of the capillary tube is broken off with sterilized forceps, and the contents are forced, by heating the air in the expanded extremity, into a test-tube containing sterile flesh-peptone-gelatine, which has been liquefied by exposure in a water bath to a temperature of 40° C., or below. The cotton plug is only removed for a moment in order to introduce the contents of the capillary tube, and in my extended experiments I have very rarely seen any accidental contamination. A rubber cap is next placed upon the open end of the test-tube and the gelatine is spread in a uniform manner over the interior of the tube by the method of Esmarch.[2] This is accomplished by rolling the tube in iced water until the gelatine hardens.

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[1] Mitth. a d. kais. Gesundheitsamte, Bd. 1.

[2] Zeitschrift für Hygiene, Bd 1, Heft 2, S. 293

These tubes are then kept at a temperature a little below the melting point of gelatine—20° to 22° C.—for at least a week. If the test organism has not been killed by the temperature to which it was exposed colonies are developed in the gelatine, which may often be recognized by the naked eye within a day or two. In other cases development is retarded, and it is only at the end of four or five days that evidence of growth is seen. The absence of growth at the end of eight or ten days is taken as evidence that the vitality of the test-organism has been destroyed by the temperature to which it was exposed. In every case a control experiment is made with material from the same culture which has not been subjected to heat.

BACILLUS OF TYPHOID FEVER.—Since the publication of Gaffky's memoir, in the second volume of the *Mittheilungen aus dem Kaiserlichen Gesundheitsamte,* his statements with reference to the formation of spores by the typhoid bacillus have been generally accepted, and have been confirmed by most of the observers who have followed him. Seitz,[1] however, has not been able to convince himself of the presence of spores in his cultures. Buchner[2] and Michael[3] also report their failure to find spores.

Gaffky states that spores are not formed at the room temperature, but that they are developed on the third or fourth day in cultures kept in an incubating oven at 37° C. These spores are said to be shining, round bodies, which occupy the whole width of the bacilli and are situated only at the ends of the rods. A single rod is said to contain but one well-developed spore, although, according to Gaffky, an imperfectly developed spore may sometimes be seen at the opposite end of a rod containing a perfect spore.

My cultures of the typhoid bacillus are from stock brought from Koch's laboratory by Dr. Meade Bolton. The morphological characters and the characteristic growth upon potato correspond perfectly with the account given by Gaffky and other authorities, and leave no doubt as to the identity of the organism which has served for my experiments. I have repeatedly seen in my potato-cultures which had been kept at 38° for several days, shining, spherical bodies, located at the ends of the rods, which appear to be spores, and which I suppose to be identical with the bodies pronounced by Gaffky to be spores. But these bodies stain with fuchsin, and if they are in truth reproductive elements, my temperature experiments show that their vitality is destroyed by a temperature of 60° C.

As my own previous experiments upon spore-bearing bacilli, and those of other experimenters, indicated that spores require for their destruction a comparatively high temperature, I made first the following experiments, in which material from a pure culture in veal broth was exposed for the time adopted as a standard (ten minutes), as follows:

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[1] Bakteriologische Studien zur Typhus—Aetiologie, München, 1886.

[2] Archiv f. Hygiene, vol. iii. p. 361.

[3] Fortschr. d. Medicin, 1886, No. 11.

Nov. 10. **50°**, 60°, 70°, **Cont.**

In this, and in all subsequent records of experiments made, the figures in heavy type indicate that growth occurred; the figures in light type indicate the absence of growth—*i. e.*, the killing of the test organism by ten minutes' exposure to the temperature indicated by the figures. It will be seen that at 60° and at 70° C. no growth occurred, while in the control tube and in that at 50° (=122° Fahr.) the typhoid bacillus grew abundantly. My object has been to determine the lowest temperature which will insure the destruction of *all* germs of each species tested. I have not therefore considered it necessary to count the number of colonies which have grown out in the Esmarch tubes in those cases where the temperature has been insufficient to accomplish the object in view. Such a record has no special advantage over the simple record of growth or failure to grow. In the practical application of data of this kind to the disinfection of typhoid excreta, etc., it is evident that a few colonies, representing a few bacilli or spores, which have survived the temperature tested, are as potent for mischief as a larger number. My experiments upon the typhoid bacillus are recorded in the following table:

TYPHOID BACILLUS.

(Ten minutes' exposure.)

Date.	Culture medium.	Experiments.	Remarks.
1886. Nov. 10.	Veal broth.	**50°**, 60, 70, **Cont.**	In oven at 38° for 48 hours.
Nov. 15.	Veal broth.	**50°, 52, 54,** 56, 58, 60, **Cont.**	Fluid culture of November 1st.
Nov. 30.	Potato culture,	**50°, 55,** 60. 70, 80, **Cont.**	Culture at room temperature.
Dec. 4.	Potato culture,	60°, **Cont.**	Culture in oven at 38° for 7 days.
Dec. 24.	Potato culture,	60°, 70, 80, **Cont.**	Culture in oven for 10 days, then kept at room temperature for 15 days.
1887. Jan. 15.	Potato culture,	55°, 60, 70, 80, **Cont.**	Culture in oven at 38° for 7 days.
Jan. 20.	Potato culture,	**48°, 50, 52,** 60, **Cont.**	In oven at 38° for 10 days.
Jan. 21.	Potato culture,	**50°**, 60, **Cont.**	Potato in oven 7 days, then kept at room temperature 7 days.

An inspection of this table shows that no development occurred in any instance after exposure to a temperature of 56° C. and above. In one experiment (Nov. 30) growth occurred after exposure to 55° C., but in this case it was very much delayed; in the experiment of January 15, no development occurred after exposure to 55°. Differences of this kind when we are on the border-line are to be expected.

We may then safely say that the thermal death-point of the typhoid bacillus is 56° C. (= 132.8° F.).

Spirillum of Asiatic Cholera (“Comma-bacillus” of Koch).—My experiments have been made simultaneously upon the cholera spirillum and the two organisms which most closely resemble it, viz., the “cheese spirillum” of Deneke and the Finkler-Prior spirillum.

The cultures in these experiments were all made at the room temperature in flesh-peptone-gelatine.

When development was retarded, the fact is indicated in the tables by a star following the figures denoting the temperature.

Date.	Organism.	Temperature to which exposed ten minutes.
December 30, 1886	Cholera spirillum.	42°, 44, 46, 48*, Cont.
	Cheese spirillum.	42°, 44, 46, 48*, Cont.
	Finkler-Prior spirillum.	42°, 44, 46, 48*, Cont.

In this first experiment no growth was observed in the Esmarch tubes containing the three organisms, after exposure to 48° for ten minutes, for several days afrer the control tubes had “broken down,” but subsequently a few colonies developed in each of these tubes. This considerable retardation of growth led me to think that a slightly longer exposure would be fatal to all of these sprilla. I accordingly made the following experiment at the same temperature, but varying the time of exposure.

Date.	Organism.	Temperature.	Time of exposure in minutes.
January 7, 1887	Cholera spirillum.	48° C. = 118.4° F.	2°, 4, 6, 8*, 10*, 12*.
	Cheese spirillum.	“ “ “	2°, 4, 6, 8*, 10*, 12*.
	Finkler-Prior spirillum.	“ “ “	2°, 4, 6, 8*, 10*, 12*.

This was followed by a similar experiment at 50° C.

Date.	Organism.	Temperature.	Time of exposure in minutes.
January 10, 1887	Cholera spirillum.	50° C. = 122° F.	2°, 4, 6, 8*, 10*, Cont.
	Cheese spirillum.	“ “ “	2°, 4, 6, 8*, 10*, Cont.
	Finkler-Prior spirillum.	“ “ “	2°, 4, 6*, 8, 10, Cont.

In this experiment only a few colonies developed after exposure for eight and ten minutes in the case of the cholera and of the cheese spirillum, and none at all in the case of the Finkler-Prior spirillum.

The following experiment was made at 52° C.

Date.	Organisms.	Temperature.	Time of exposure in minutes.
January 31, 1887	Cholera spirillum.	52° C. = 125.6° F.	2°*, 4, 6, 8, 10, Cont.
	Cheese spirillum.	" " "	2°*, 4, 6, 8, 10, Cont.
	Finkler-Prior spirillum.	" " "	2°, 4, 6, 8, 10, Cont.

It will be noted that identical results were obtained throughout with the cholera and the cheese spirillum, while the Finkler-Prior spirillum proved to have a little less resisting power to heat.

The following experiment gives a result in accord with the above. It was made for the purpose of testing the question whether a difference would be shown in the resisting power of old and recent cultures. I may remark here that the cholera spirillum retains its vitality for several months, at least, in cultures which are kept in a moist condition. On the other hand, Koch has shown that it is quickly destroyed by desiccation.

Date.	Cholera spirillum.	Temperature	Time of exposure in minutes.
January 17, 1887	Fresh culture.	52° C. = 125.6° F.	2°*, 4, 6, Cont.
	Culture 13 days old.	" " "	2°*, 4, 6, Cont.

ANTHRAX BACILLUS.—Davaine first made experiments (1873) to determine the temperature required to destroy the vitality of the anthrax bacillus as found in the blood of an animal just dead. Under these circumstances no spores are present. The destruction of vitality was tested by inoculation into susceptible animals. This method is open to the objection that at temperatures approaching that which destroys vitality the development of the bacillus is retarded, and the animal is likely to suffer a non-fatal attack of the disease, which may escape observation. This is probably the explanation of the slight difference in the results obtained by Davaine and those of Chauveau made more recently.

Authority.	Temperature.	Time of exposure.	Remarks.
Davaine	48°	15 minutes.	In blood.
Davaine	50	10 "	" "
Davaine	55	5 "	" "
Chauveau	50	20 "	Cultures.
Chauveau	54	10 "	"

According to Flügge, anthrax spores are killed by exposure to 100° C. for two minutes. In a recent experiment by the writer a single colony developed after exposure to this temperature for two minutes, but there was no growth when the time was extended to four minutes.

BACILLUS OF GLANDERS—Löffler[1] has recently determined the thermal death-point of the *Rotz* bacillus. He finds it to be 55° C., the time of exposure being ten minutes.

BACILLUS OF SWINE PLAGUE (German, *Schweine rothlauf;* French, *Rouget*). BACILLUS OF MOUSE SEPTICÆMIA (Koch).—Pasteur's bacillus of *rouget* is, no doubt, identical with the bacillus of *Schweine rothlauf* of the German bacteriologists. I have experimented upon cultures from both sources. The bacillus of mouse septicæmia is also supposed by some authors to be identical with the above. According to Eisenberg, the bacillus of mouse septicæmia forms spores. Flügge says of the bacillus of *Schweine rothlauf:*

> "In bouillon cultures which have been kept for three days at the room temperature, or for twenty-four hours at 40°, one notices the formation of small spherical bodies, which probably represent spores; although, on account of their minuteness, the formation and development of these bodies have not, up to the present time, been exactly observed."[2]

My experiments upon the thermal death-point of these organisms are included in the following tables.

CULTURES IN FLESH-PEPTONE-GELATINE.

Date.	Organism.	Temperature to which exposed.
January 20, 1887	Mouse septicæmia.	50°, 60, Cont.
January 26, "	Mouse septicæmia. Schweine rothlauf.	52°, 54, 56*, 58, Cont. 52°, 54, 56, Cont.
February 7, "	Mouse septicæmia. Schweine rothlauf.	60°, Cont. 60°, Cont.
February 8, "	Mouse septicæmia. Rouget.	54°, 56*, 58, Cont 52°, 54, 56*, 58, Cont.

CULTURES IN BOUILLON.

Date.	Organism.	Temperature to which exposed.
March 17, 1887	Rothlauf.	60°, 65, Cont.
	Mouse septicæmia.	60°, 65, Cont.

These bouillon cultures were kept in the incubating oven at 38° for three days, and afterward at the room temperature for eight days. The bacilli were found to have grown out into slender filaments, which presented the appearance of having vacant places in their protoplasm, which possibly represented spores. As will be seen by reference to the table, no growth occurred after exposure to a temperature of 60° C. for ten minutes. We must, therefore, admit either that this bacillus does not form spores under the circumstances stated by Flügge, or that the spores are destroyed at the comparatively low temperature named.

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[1] Arbeiten a. d. Kaiserlichen Gesundheitsamte, Bd. 1, Heft 5.

[2] Die Mikroörganismen, p. 246.

In the following table I include several species of pathogenic and non-pathogenic bacilli in which the question of spore-formation has not been definitely settled. In regard to the first-named (Emmerich's bacillus) Eisenberg remarks "spore-formation not yet observed." According to Flügge, *B. sputig. crassus* "appears to form spores at a temperature of 35°." The bacillus of blue milk is said by Eisenberg to form spores in gelatine cultures after the third day. The lactic acid ferment is said by the same author to form spores at the ends of the rods, which appear as spherical, shining, highly refractive bodies. In my own examinations of stained cover-glass preparations from the cultures used in the following experiments, I have in no instance been able to satisfy myself of the presence of spores.

RECENT CULTURES IN FLESH-PEPTONE-GELATINE.

Organism.	Date.	Temperature to which exposed ten minutes.
Emmerich's bacillus	January 24,	60°, Cont.
	January 28,	70°, 80, 90, 100, Cont.
	February 1,	60°, 62, 64, Cont.
Brieger's bacillus	January 24,	60°, Cont.
	February 1,	58°*, 60*, 62°, Cont.
Friedländer's bacillus (So-called "pneumo-coccus.")	December 24,	50°, 52*, 54*, Cont.
	January 8,	58°, 60, 62, 64, Cont.
	January 11,	54°, 56,* 58, Cont.
	January 20,	56°, 58, Cont.
Bacillus sputig. crassus (Kreibohm.)	January 24,	60°, Cont.
	January 28,	50°, Cont.
	January 31,	54°, 56, 58, Cont.
Bacillus pyocyanus (Green pus.)	December 24,	70°, 80, Cont.
	December 31,	46°, 48, 50, Cont.
	January 8,	58°, 60, 62, 64, Cont.
	January 17,	52°, 54*, Cont.
	February 2,	54°, 56, 58, Cont.
Bacillus indicus	January 21,	56°*, 60, Cont.
	January 25,	56°, 58, Cont.
	January 26,	52°*, 54*, 56, Cont.
	February 2,	54°, 56, 58°, Cont.
Bacillus prodigiosus (Commonly called micrococcus prodigiosus.)	January 21,	56°, 60, Cont.
	January 25,	56°, 58, Cont.
	January 26,	52°*, 54*, 56*, Cont.
	February 2,	54°*, 56, 58, Cont.
Bacillus cyanogenus (Bacillus of blue milk.)	January 28,	50°, 60, Cont.
	January 31,	54°, 56, 58, Cont.
Bacillus fluorescens	January 28,	50°, 60, Cont.
	January 31,	54°, 56, 58, Cont.
Bacillus acidi lactici	January 24,	60°*, Cont.
	January 26,	52°, 54, 56, Cont.
	February 1,	60°, 62, 64, Cont.
	February 8,	54°, 56, 58, Cont

POTATO CULTURES IN INCUBATING OVEN FOR THREE DAYS, AT 38°, TO TEST FOR SPORES.

(No spores seen on microscopic examination of stained cover-glass preparations.)

Organism.	Date.	Temperature to which exposed.
Bacillus pyocyanus	March 1, 1887.	60°, 65, Cont.
Emmerich's bacillus	" "	60°, 65, Cont.
Brieger's bacillus	" "	60°, 65, Cont.
Bacillus acidi lactici	" "	60°, 65, Cont.

OLD CULTURES IN FLESH-PEPTONE-GELATINE, TO TEST FOR SPORES.

(March 7, 1887.)

Organism.	Age of culture.	Temperature to which exposed.
Brieger's bacillus	36 days.	60°, 65, Cont.
Emmerich's bacillus	43 "	60°, 65, Cont.
Bacillus pyocyanus	46 "	60°, 65, Cont.
Bacillus fluorescens	42 "	60°, 65, Cont.
Bacillus cyanogenus	33 "	60°, 65, Cont.
Bacillus acidi lactici	42 "	60°, 65, Cont.

It will be seen that in all of these experiments the lactic acid ferment is the only one which resisted a temperature of 60° C; and if the presence of spores could be determined by this test, this is the only organism in the list in which there is any evidence of spore formation. I am not, however, disposed to accept this test, and think it not improbable that some of the bacilli in the list form reproductive spores, which differ from those of the anthrax bacillus and certain other spore-forming bacilli, in the fact that they are destroyed at a comparatively low temperature. The only way to settle this question will be by the method of direct observation. If the refractive spherical bodies, supposed to be spores, which may be seen in potato cultures of the typhoid bacillus, in bouillon cultures of the bacillus of swine plague, etc., are observed to develop into bacilli, they will be demonstrated to be reproductive elements, or spores, notwithstanding the fact that they are destroyed by so low a temperature as 60° C.

The following experiments have been made with pathogenic and non-pathogenic bacilli which are known to form spores.

Organism.	Date.	Temperature to which exposed ten minutes.
Bacillus alvei (foul brood of bees)	December 8, December 30,	80°, Cont. 90°, 100, Cont.
Wurtzel bacillus	January 24, January 28,	60°, Cont. 70°, 80, 90, Cont.
Bacillus butrycus	December 28, December 31,	80°, Cont. 90°, 100, Cont.

The following experiments have been made upon these spore-forming bacilli at a temperature of 100° C. (212° F.). the time of exposure being varied.

Organism.	Date.	Time of exposure in minutes.
Anthrax bacillus	February 9,	2*, 4, 6, 8, 10, Cont. * A single colony.
Bacillus alvei	February 9,	2*, 4, 6, 8, 10, Cont. * A few colonies.
Bacillus butrycus	February 9,	2, 4, 6, 8, 10, Cont.
Wurtzel bacillus	March 4,	2*, 4, 6, 8, 10, Cont. * A single colony.

Bacillus Tuberculosis.—Schill and Fischer (1884), assuming that the tubercle bacillus forms spores, made quite a number of experiments to determine its thermal death-point. Using fresh sputum as the material, and testing the destruction of the vitality of the bacilli contained in this material by inoculations into guinea-pigs, they found that exposure to a temperature of 100° C., in steam, was efficient when the time of exposure was five minutes. When the time was reduced to two minutes a negative result was obtained in two out of three guinea-pigs inoculated, but in one death from tuberculosis occurred.

My experiments upon micrococci are recorded in the following table.

Recent Cultures of Micrococci in Flesh-peptone-gelatine.

Organism.	Date.	Temperature to which exposed ten minutes.
Micrococcus of osteomyelitis	December 8, 1886. December 20, February 8, 1887.	50°, 52, 54, 56, 58, Cont. 52°, 54, 56*, Cont. 54°, 56*, 58, Cont.
Staphylococcus pyog. aureus	January 11, 1887.	54°, 56*, 58, 60, Cont.
Staphylococcus pyog. citreus	January 8, 1887. January 11, January 20,	58°, 60*, 62, 64, Cont. 54°, 56, 58*, 60*. 56°, 58*, 60, Cont.
Staphylococcus pyog. albus	December 26, 1886. January 11, 1887.	52°, 54, 56*, Cont. 54°, 56, 58*, 60*.
Streptococcus erysipelatus	December 28, 1886. January 20, 1887. January 25,	48°, 50, 52, Cont. 50°. 52, 58, Cont. 54°, 56, Cont.
Micrococcus tetragenus	January 25, 1887.	54°, 56*, 58, Cont.
Micrococcus Pasteuri	March 29, 1887. April 7,	50°, 52, 54, 56, 58, Cont. 46°, 48, 50*, 52, Cont.

Fresh Cultures of Sarcinæ in Flesh-peptone-gelatine.

Organism.	Date.	Temperature to which exposed.
Sarcina aurantiaca	December 24, 1886.	56°, 58*, 60*, Cont.
	January 11, 1887.	54°, 56, 58*, 60.
	January 18,	58°, 60, Cont.
Sarcina lutea	December 29, 1886.	56°, 58*, 60*, Cont.
	January 7, 1887.	58°, 60*, 62*, 64, Cont.
	January 11,	56°, 58, 60*, Cont.
	January 18,	60°*, 62, 64, Cont.

Gonococcus of Neisser.—Believing, as I now do, that this organism is the cause of the infectious virulence of gonorrhœal secretions (see *The Medical News* of Feb. 26, 1887), I have made the following experiment with reference to its thermal death-point. Some gonorrhœal pus from a recent case which had not undergone treatment, was collected for me by my friend, Dr. George H. Rohé, in the capillary tubes heretofore described. A microscopical examination of stained cover-glass preparations showed that this pus contained numerous "gonococci" in the interior of the cells. Two of the capillary tubes were placed in a water bath maintained at 60° C. for ten minutes. The pus was then forced out upon two pledgets of sterilized cotton wet with distilled water. Two healthy men had consented to submit to the experiment, and one of these bits of cotton was introduced into the urethra of each and left *in situ* for half an hour. As anticipated, the result was entirely negative. For obvious reasons no control experiment was made, and no attempt was made to fix the thermal death-point within narrower limits.

In connection with these experiments upon the thermal death-point of known pathogenic organisms, it is of interest to inquire whether the virulence of infectious material in which it has not yet been demonstrated that this virulence is due to a microörganism, is destroyed by a correspondently low temperature. Evidently, if this proves to be the case, it will be a strong argument in favor of the view that we have to deal with a microörganism in these diseases also. We have experimental proof that a large number of pathogenic organisms are killed by exposure for ten minutes to a temperature of from 55° to 60° C. But, so far as I am aware, this low temperature would not be likely to destroy any of the poisonous chemical products which might be supposed to be the cause of infective virulence—leaving aside the fact that such chemical products have no power of self-multiplication, and, therefore, could not be the independent cause of an infectious disease.

Vaccine Virus.—Carstens and Coert have experimented upon the temperature required to destroy the potency of vaccine virus. In a paper read at the meeting of the International Medical Congress, in 1879, they report as the result of their experiments that the maximum degree of heat to which fresh vaccine can be exposed without losing its virulence, probably varies between 52° and 54° C.

RINDERPEST.—According to Semmer and Raupach,[1] exposure for ten minutes to a temperature of 55° C. destroys the virulence of the infectious material in this disease.

SHEEP-POX.—The authors last mentioned[2] have also found that the same temperature—55° C. for ten minutes—destroys the virulence of the blood of an animal dead from sheep-pox.

HYDROPHOBIA.—Desiring to fix the thermal death-point of the virus of hydrophobia, I obtained through the kindness of Dr. H. C. Ernst, a rabbit which had been inoculated, by the method of trephining, with material which came originally from Pasteur's laboratory (see Dr. Ernst's paper in the April number of this journal). The rabbit sent me showed the first symptoms of paralytic rabies on the eighth day after inoculation. It died on the eleventh day (March 2, 1887), and I at once proceeded to make the following experiment:

A portion of the medulla was removed and thoroughly mixed with sterilized water, the milky emulsion was introduced into four capillary tubes, such as had been used in my experiments heretofore recorded. Two of these tubes were then placed for ten minutes in a water bath, the temperature of which was maintained at 60° C. Four rabbits were now inoculated by trephining, two with the material exposed to 60° C. for ten minutes, and two with the same material from the capillary tubes not so exposed. The result was as definite and satisfactory as possible. The two control rabbits were taken sick, one on March 10, and one on the 11th; both died with the characteristic symptoms of paralytic rabies on the third day. The two rabbits inoculated with material exposed to 60° C. remained in perfect health. On the 26th of March one of these rabbits was again inoculated by trephining with material from the medulla of a rabbit just dead from hydrophobia. This rabbit died from paralytic rabies on the 8th of April. Its companion remains in perfect health.

A second experiment was made in the same way on the 14th of March. Two rabbits were inoculated with material exposed for ten minutes to a temperature of 50° C.; two with material exposed for the same time to a temperature of 55° C.; and two control rabbits with material not so exposed. One of the rabbits inoculated with material exposed to 50° C. and one of the control rabbits died on the 25th, the other rabbit inoculated with the material exposed to 50°, the other control, and one inoculated with material exposed to 55°, on the 26th. The second rabbit inoculated with material exposed to 55° died five days later with the characteristic symptoms of the disease.

These experiments show then that the virus of hydrophobia is destroyed by a temperature of 60° C., and that 55° C. fails to destroy it—the time of exposure being ten minutes.

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[1] Deutsche Zeitschrift für Thier med., vii. p. 347.

[2] Ibid.

For convenience of reference the results obtained in my own experimental studies, and those of others referred to, are brought together in a single table. Where the determination has not been made by myself the authority is given in parentheses after the name of the organism. The time of exposure is ten minutes, unless otherwise indicated by figures in parentheses following those representing the temperature. The table includes those non-pathogenic organisms which have been tested as well as those which are recognized as pathogenic. In this table I have adopted the nomenclature used by Dr. Flügge in his recent work *Die Mikroörganismen.*

THERMAL DEATH-POINT OF MICROÖRGANISMS.

NAME OF ORGANISM.	CENTIGRADE.	FAHRENHEIT.
Spirillum choleræ Asiaticæ	52°	125.6° (4 m.)
Spirillum tyrogenum[1]	52	125.6 (4 m.)
Spirillum Finkler-Prior	50	122
Bacillus anthracis (Chauveau)	54	129.2
Bacillus typhi abdominalis	56	132.8
Bacillus mallei[2] (Löffler)	55	131
Bacillus of schweine-rothlauf (Rouget of Pasteur)	58	136.4
Bacillus murisepticus	58	136.4
Bacillus Neapolitanus[3]	62	143.6
Bacillus cavicida[4]	62	143.6
Bacillus pneumoniæ[5]	56	132.8
Bacillus crassus sputigenus	54	129.2
Bacillus pyocyanus	56	132.8
Bacillus indicus	58	136.4
Bacillus prodigiosus	58	136.4
Bacillus cyanogenus	54	129.2
Bacillus fluorescens[6]	54	129.2
Bacillus gallinarum (Salmon)[7]	56	132.5
Bacillus acidi lactici[8]	56	132 8
Bacillus alvei; spores	100	212 (4 m)
Bacillus anthracis; spores	100	212 (4 m.)
Bacillus butrycus; spores	100	212 (4 m.)
Bacillus mycoides; spores	100	212 (4 m.)
Bacillus tuberculosis (Schill and Fischer)	100	212 (4 m.)
Staphylococcus pyogenes aureus	58	136.4
Staphylococcus pyogenes citreus	62	143 6
Styphylococcus pyogenes albus	62	143.6
Streptococcus erysipelatus	54	129.2
Micrococcus tetragenus	58	136.4
Micrococcus Pasteuri	52	125.6
Micrococcus gonorrhœa[9]	60	140
Sarcina lutea	64	147.2
Sarcina aurantiaca	62	143.6
Vaccine virus (Carstens and Coert)	54	129.2
Rinderpest virus (Semmer and Raupach)	55	131
Sheep pox virus (Semmer and Raupach)	55	131
Hydrophobia virus	60	140

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[1] Cheese spirillum. [2] Bacillus of glanders. [3] Emmerich's bacillus.

[4] Brieger's bacillus. [5] Friedländer's. [6] From water.

[7] Pasteur's "microbe du cholera des poules."

[8] Old culture in flesh-peptone-gelatine not killed by 60°, probably owing to the presence of spores.

[9] A single experiment. A lower temperature would probably be effective.

By reference to the various tables giving the experimental data in detail, it will be seen that the results are not absolutely uniform for the same organism. Thus, in the experiments upon the typhoid bacillus no growth occurred after exposure to 55° in one experiment (January 15), while in another (November 30) colonies of the typhoid bacillus grew out after exposure to this temperature. In this case the thermal death-point is placed at 56°, no growth having occurred after exposure to this temperature. Similar differences, when the temperature approaches that which is uniformly successful in destroying vitality, may be observed with reference to several of the organisms tested. But these differences are within comparatively narrow limits. They are probably due partly to a difference in resisting power depending upon the age of the culture, and partly to unavoidable variations in the temperature during the experiments. By very careful supervision and frequent stirring of the water-bath, variations in temperature have been kept within narrow limits, but it has been impossible to avoid them entirely. The same thermometer has been used throughout (made by Schlag and Berend, Berlin).

No attempt has been made to fix the thermal death-point within narrower limits than 2° C., and in the above table the lowest temperature is given which has been found, in the experiments made, to destroy all of the organisms in the material subjected to the test. No doubt more extended experiments would result, in some instances, in a reduction of the temperature given as the thermal death-point for a degree or more. But the results as stated are sufficiently accurate for all practical purposes, and permit us to draw some general conclusions:

(*a*) The temperature required to destroy the vitality of pathogenic organisms varies for different organisms.

(*b*) In the absence of spores, the limits of variation are about 10° Centigrade (18° F.).

(*c*) A temperature of 56° C. (132.8° F.) is fatal to the bacillus of anthrax, the bacillus of typhoid fever, the bacillus of glanders, the spirillum of Asiatic cholera, the erysipelas coccus, to the virus of vaccinia, of rinderpest, of sheep-pox, and probably of several other infectious diseases.

(*d*) A temperature of 62° C. (143.6° F.) is fatal to all of the pathogenic and non-pathogenic organisms tested, in the absence of spores (with the single exception of *sarcina lutea*, which, in one experiment, grew after exposure to this temperature).

(*e*) A temperature of 100° C. (212° F.) maintained for five minutes destroys the spores of all pathogenic organisms tested.

(*f*) It is probable that some of the bacilli which are destroyed by a temperature of 60° C. form endogenous spores which are also destroyed at this temperature.[1]

The experimental study, the results of which are recorded in the present paper, was made, through the courtesy of Prof. Wm. H. Welch, in the pathological laboratory of Johns Hopkins University.

A CONSIDERATION OF THE RESULTS IN 327 CASES OF TRACHEOTOMY,

PERFORMED AT THE BOSTON CITY HOSPITAL FROM 1864 TO 1887.

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FORMERLY HOUSE SURGEONS AT THE HOSPITAL.

The operation of tracheotomy was performed for croup 327 times at the Boston City Hospital from the time of its foundation in 1864 to January, 1887. Up to the year 1880, only 30 tracheotomies had been done, so that the greater part of the operations have been performed in the last six years. It should be noted, in passing, that a bad class of cases would naturally come to a city hospital for operation. In most instances being treated at home, medically, until an operation has become imperative and long after it has become advisable, they are brought hurriedly for operation often in a hopelessly bad condition. If the parents wish or if an operation seems likely to afford even temporary relief to the patient, tracheotomy is performed, and thus many hopeless cases are yearly operated upon; all of which are included in the analysis. We are indebted to the visiting surgeons of the hospital for permission to publish the following cases.

Of the 327 cases, 232 died and 95 (29.05 per cent.) recovered. The causes of death were, septicæmia in 62 cases, extension of the diphtheritic process to the trachea and bronchi (doubtless including many pneumonia cases) in 101 cases, exhaustion in 12 cases, death on the table in 10 cases, heart failure in 6 cases, various causes (pneumonia, peritonitis, scarlet fever, nephritis, embolism, marasmus) in 6 cases, undetermined in 35 cases.

Autopsies were so few that a clinical estimate of the cause of death had to serve in most cases; such a classification is approximate at best and the distinctions were by no means always clear. When death was preceded by gradually increasing dyspnœa it was considered that extension of the diphtheritic process to the bronchi was the cause of death and the truth of this was often proved by autopsy. In other cases profound septic poisoning was evident as the chief cause of death. These are the two great classes into which the majority of cases fall, other causes of death seeming incidental. Children with septicæmic symptoms died more quickly after operation than those dying by extension of the process to the bronchi. An average of the two classes showed that septicæmic patients died on the average two days after operation, while children dying by extension lived three days.

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[1] This question demands further experimental investigation.

The relation of the number of deaths from extension to those from septicæmia is shown below.

	Extension.		Septicæmia.
In all the fatal cases	$1\frac{2}{3}$	to	1
In children under 2 years	$3\frac{1}{3}$	to	1
In children from 2 to 10 years	$1\frac{1}{3}$	to	1

It can be seen from this that young children are particularly liable to that distressing cause of death, extension of the process to the bronchi. When this happens there is no euthanasia, death is the slowest and most painful of suffocations, and only when septicæmia to the point of stupefaction is present at the same time does the child escape a horrible amount of suffering. The frequency of this painful ending then is not to be lost sight of in recommending the operation as a means of euthanasia, especially in children under two years of age.

10 cases died on the table. 2 of these evidently died of heart failure, for they stopped breathing before the trachea was opened and had but slight hemorrhage. 4 had profuse hemorrhage, and 2 died of shock some little time after the tube was put in place and everything seemed favorable. In the remaining 2 cases the records are not full. The 6 cases classed as heart failure did not die on the table, but from the first to the fifth day after operation.

An attempt was made to find the ultimate result in the 95 patients that recovered. 23 cases recovered in 1886, and were considered as too recent to be of value.

Of the 72 that recovered previous to January, 1886, 56 have been personally investigated, while 16 could not be found. The research was made especially difficult by the fact that it was so common for the parents to move after an attack of diphtheria and the consequent investigation by the Board of Health. Of the 72 families, 57 had moved at least once. 15 cases were seen from one to two years after operation; 16 cases in three years; 12 cases in four years; 2 cases in five years; 6 cases in six years; 4 cases in seven years; 1 case in twenty-one years. 26 have never been ill in any way since recovery from the operation.

7 have had pneumonia, measles, or mumps, but have fully recovered, no one of them having had croup at the time of illness. 2 have had diphtheria a second time without laryngeal complication; 1, nine years old, two years after operation, and 1, twenty years old, four years after.

With eight exceptions, the patients have been free from any attack of croup since operation. One, five years old, operated on in 1885, has had two attacks, one of which was quite severe. One, ten years old, operated on in 1884, has had one or two attacks, and is in poor general condition. One, four years old, operated on in 1885, is apt to be croupy with a slight cold. One, six years old, operated on in 1885, the same. One, fourteen years old, operated on in 1883, the same. One, ten years old, operated on in 1885, has croupy cough. One, seven years old, operated on in 1884, was liable to be croupy for a while after operation, but is not so now. One, eleven years old, operated on in 1883, the same.

Of complications coming after operation, one had nephritis and paralysis, but recovered; one had nephritis for four months. One had "abscesses." One, a boy ten years old, operated on in 1881, could not blow his nose for two years, but is well now.

There have been no deaths in the 56 cases investigated, and there is no reason to believe that these are any more favorable than the 16 that could not be found.

As to present condition, 53 may be said to be in good general health: 10 to 15 are said to take cold more easily than before. That it is not a very serious matter may be seen by the fact that only 6 are said to be liable to sore throats, of whom 2 have tonsillitis at times, and the remainder are liable to have sore throats when they catch cold. Of the 3 who were found not to be in good condition, one, six years old, operated on a year and a half ago, has phthisis, but no laryngeal symptoms. The second, noted above, is in bad general condition, hoarse, and croupy. The third is a delicate boy, five years old, with no positive signs of trouble except a tendency to croup and illness.

The voice is clear in all but 4 cases; in one of the latter, a girl of thirteen, operated on two years ago, the voice is not so clear as before operation, and she cannot sing so high as before. The second, four years old, has a fairly clear voice, but it is said to be less so than before operation, two years ago; two are said to be hoarse when they have slight colds. The scars in all cases are healed and are more or less conspicuous according to the severity of the original wound; none were found adherent, and in no instance had the scar travelled downward toward the sternum as mentioned by Neukomm.[1] In nearly all the cases a linear depression in the trachea admitting the edge of the finger-nail could be felt at the site of the original wound, but in one case operated on in 1880, by the low operation, no nick was felt in the trachea.

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[1] Neukomm: Centralb. f. Chirurg., 1885, No. 38.

There were 4 cases of stenosis which are noted later in the article.

It has been stated that[1] the operation tends to become less fatal in any place as the years go by. In Berlin[2] the death-rate after operation fell 22 per cent. in six years, and in Paris,[3] at the Hôpital des Enfants Malades, it fell nearly 30 per cent. in six years.

In 11,696 cases reported by Agnew,[4] in 1878, the recovery per cent. was 26.25. In 1137 cases reported since then which were grouped merely for comparison on this point, the recovery rate was 33.8 per cent. But in the present series of cases no such result was noted. From 1881 to 1885 the recovery per cent. fell from 35 to 26; in 1886 it rose again to 29, but the general tendency has been downward, a fact which is probably dependent on the extension of the operation to more and more hopeless cases each year. Moreover, Wanscher,[5] in Copenhagen, in several years noted no such falling off in the fatality per cent. Statistics definite enough to clear up the point are too few.

It became apparent while studying the cases that there was a marked variation in the proportion of recoveries at the different seasons of the year. Therefore, a calculation was made of the average monthly mortality per cent. in each of the twelve months for five years preceding 1886, and the result is shown graphically in Table I. It will be seen that in the winter months the smallest proportion of cases recover, not 20 per cent. in December, February, and March, while from the latter month the recovery rate rises until July, when about 60 per cent. of all cases operated on get well. In a general way, each year showed the same tendency when considered by itself. As a matter of interest, the per cent. of mortality from diphtheria in the city at large was calculated by the month for the same five years from the tables of the Board of Health,[6] and a very striking correspondence was noticed. The diphtheria mortality per cent. curve is shown in Table IV.

To see if the tracheotomy mortality per cent. bore a similar relation to other zymotic diseases than diphtheria, the monthly mortality per cent. of scarlet fever (chosen only as a representative) for the same five years was calculated for the whole city, and the result is shown in Table VII.

By comparison of these three tables it will be seen that from 1881 to 1885 inclusive, the tracheotomy death-rate at the Boston City Hospital varied by the month in the closest correspondence to the mortality per cent. of diphtheria for the same time in the whole city of Boston, and that it did not vary at all in correspondence with the death-rate from scarlet fever in the whole city. Nor does it correspond to the general monthly mortality of the city for all diseases during the same five years. In a word, when diphtheria is most fatal in the city, tracheotomy is most fatal at the hospital. That this variation is not due to the greater prevalence of scarlet fever or diphtheria at different seasons is shown by Tables II. and V., which show the monthly number of cases reported for the five years of each disease. It is also of much interest to see how closely the number of deaths from croup and diphtheria in the whole city correspond when considered by the month in the same way. (Table III.) The same correspondence was noted for 1876–77 by Dr. F. W. Draper.[1]

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[1] Hugonnai: Das erste 100 Croup Operationen in Zürich. Inaug. Diss., Zürich, 1878.

[2] Krönlein: Archiv f. klin. Chir., Bd. xxi. Heft 2.

[3] Bourdillat: Bull. et Soc. Méd. Hôp. Paris, 1867, 39.

[4] Agnew: System of Surgery, vol. iii.

[5] Wanscher: Om Diphtheritis og Croup saerlight med. Hyensyen til Tracheotomien ved Samme for Doctor graded i Medicinen. Kjoebenhavn, 1877.

[6] Reports of the Boston Board of Health, 1881–85.

It does not come within the scope of this paper to enter upon any discussion as to the identity of croup and diphtheria; at the same time it is easy to see that the correspondences and variations noted above lend a very strong weight to the assertion that croup and diphtheria are one and the same disease. However it may be in other places, idiopathic, non-diphtheritic croup is very rare in Boston; whether it exists at all is questioned by many. The overwhelming majority of all cases coming for operation to the hospital present some signs of diphtheritic infection, membrane in the throat or nose, enlarged glands in the neck, albuminuria, septicæmia, and the like.

If the seasonal death-rate from diphtheria in a city affects the tracheotomy death-rate so much as our tables would seem to show, we should expect that in cities where a low death-rate from diphtheria prevails unusually favorable results would follow tracheotomy. And this may account for the otherwise inexplicable figures given by Wanscher, of Copenhagen, where of 400 cases operated on in hospital practice 42 per cent. recovered. The table shows the rest.

	To the 1000 of the living population.
General death-rate in Copenhagen, 1880–1885	22.8
General death-rate in Boston, 1880–1885	22.5
Diphtheria death-rate in Copenhagen, 1880–1885	0.25
Diphtheria death-rate in Boston, 1880–1885	1.35

Unfortunately, statistics are not to be obtained for similar investigation in other cities.

The presence of membrane in the pharynx is by no means an invariable accompaniment of the laryngeal trouble, for it was noted as having been present in the pharynx in 158 cases and absent in 93, while in 76 there was no definite note. It was undoubtedly seen but not noted in many cases, whereas nearly every case in which it was absent was probably entered in the notes, so that the figures given above by no means represent the true proportion. But the interest of the two classes of cases lies in the difference of their death-rates. Of the 158 cases where membrane was present in the pharynx at the time of operation 44 or 28 per cent. recovered, in the 93 cases where membrane was absent from the pharynx 37.6 per cent. recovered.[1] That this difference in the per cent. is not due to the fact that the cases where membrane was absent were older children, is shown by the average age of the two classes:

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[1] Reports of Boston Board of Health, 1877–78.

Where membrane was present the average age of the 158 cases was 4.4 years.

Where membrane was absent the average age of the 93 cases was 4.1 years.

That is, in spite of the fact that the children were younger, 10 per cent. more recovered where membrane was not present in the pharynx at the time of operation.

In the majority of cases the attack of croup had been preceded by illness varying from one to seven days in duration. Oftenest there was the history of an attack of pharyngeal diphtheria preceding, but sometimes there had only been a day or so of general malaise without definite throat symptoms. In an average of 225 cases the attack of croup came on the fifth day of the illness, and in only 10 cases was the croup not preceded by at least one day's illness.

Perhaps the most important question of all is the influence of early or late operation as it affects recovery, as it is one of the very few conditions under the control of the surgeon. The table shows the recovery-rate in cases operated upon within one, two, three, and four days after the beginning of the obstructed respiration.

Day of operation.	Number of cases.	Recovery.	Per cent. of recovery.
1	123	40	32.5
2	86	24	28.0
3	33	8	25.3
4	7	1	14.0

In the same line of argument the amount of the patient's dyspnœa at the time of operation serves to advocate the performance of tracheotomy while the dyspnœa is yet moderate. In 154 cases the dyspnœa before operation was noted as "severe;" of these, 21 per cent. recovered. In 124 where it was noted as "moderate," 35 per cent. recovered. The argument against early operation is of course the possibility of a patient's recovery from even severe dyspnœa without tracheotomy; on this point authorities differ very widely. Steiner[1] has seen only three recoveries of this sort. Mackenzie[2] sets the death-rate without operation at 90 per cent., and in 33 cases of croup treated medically many years ago by Dr. John Ware,[3] 30 died. On the other hand are arrayed Lewis Smith,[4] Meigs and Pepper,[5] and Agnew,[6] who believe that recovery without operation is more frequent than has commonly been supposed. The experience at the City Hospital has been as follows: forty cases of diphtheritic croup have been treated medically and every one died. Dr. G. W. Gay, visiting surgeon, wrote in 1885,[7] "Not a single case of pseudo-membranous laryngitis has ever recovered in this hospital without operation." And he quoted Dr. D. W. Cheever, senior visiting surgeon, as writing to him in 1884,[8] "After reflection I cannot recall a case of membranous laryngitis that I have known to recover without tracheotomy." Since Dr. Gay's article was written there have been two recoveries from moderate dyspnœa without operation.

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[1] Honsell: Aerztl. Mittheil. aus Baden, xxxvi., 1882.

The age of the patient is, of course, an important consideration, the mortality-rate falls as the age increases, up to eight or ten years. In 1600 cases collected from Cohen,[9] Schüller,[10] Birnbaum,[11] Mastin,[12] etc., and tabulated with regard to the age of the patients, the recovery-rate in children less than two years old was 20 per cent., rising steadily until the age of eight years was reached, when it was 40 per cent. The 327 cases reported here followed much the same course, except in the youngest children, where the operation proved much more fatal. Of 42 patients under two years of age only 3 recovered, 1 eleven months old, and 2 fifteen months old, all nursing children. The oldest case to recover was a girl sixteen years old, and several adults died.

There are several minor symptoms that deserve mention. Nasal discharge was almost always present and had no special significance. When it was associated with severe septicæmia it was ordinarily foul-smelling. Cervical glandular swelling, in the same way, was generally present, being noted as absent in only 24 cases. It was present in all sorts of cases, and its only significance was that when it gradually increased after operation, death from septicæmia followed in an overwhelming majority of cases. To be sure, two or three cases got well after having developed an amount of glandular swelling that made the neck double its ordinary size, but in general when the neck tape had to be loosened, after it was once tied in place, it meant death for the patient.

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[1] Steiner, quoted by Gay: Wood's Ref. Handbook of Med. Sci, vol. ii. p. 344.

[2] Mackenzie: Diseases of the Throat and Nose.

[3] Ware, quoted by Gay, Ibid.

[4] Lewis Smith: Dis. of Children, Phila., 1881; also Amer. Journ. of Med. Sci., April, 1885, p. 319.

[5] Meigs and Pepper: Diseases of Children.

[6] Agnew, loc. cit.

[7] Gay: Wood's Ref. Handbook of Med. Sci., vol. ii. p. 344.

[8] Gay: Phila. Med. News, July 12, 1884.

[9] Cohen: Croup in its Relation to Tracheotomy, 1884.

[10] Schüller: Deutsche Chir., Lief 37, Stuttgart.

[11] Birnbaum: Arch. f klin. Chir., xxxi. p. 333.

[12] Mastin: Gaillard's Med. Journ., xxix. 1 p. 1.

Albumen was present in the urine of five-sixths of all the cases in which an examination was made and recorded (75 in number). It appeared in all classes of cases and was particularly abundant in bad cases of septicæmia. Sugar was temporarily present in the urine of one child who recovered.

The discharge from the trachea tube after operation furnished perhaps the most important indication of a patient's progress. The discharge was classified as loose and as gummy, and the line between the two classes was easy enough to draw ordinarily. The inner tube was always taken out and cleaned every two or three hours, and at these times the character of the discharge taken from it was noted. Sometimes there was no discharge at all, and then the case was classed as "discharge suppressed;" when it was gummy it was always scant. The importance of the tube discharge with reference to the prognosis of the cases is shown in the following table:

	Number of Cases.	Number of Recoveries.	Per cent.
When the discharge was loose throughout	83	53	60
When the discharge was gummy at any time, even temporarily . . .	86	11	13
When the discharge was suppressed .	15	0	0

The notes were indefinite in the other 143.

The appearance of blood in the tube discharge was a matter of no significance. It was always present for a while after operation and reappeared in all classes of cases at irregular intervals, sometimes as late as the fifth day after operation.

The temperature possessed no more than its usual significance in acute febrile diseases; when it rose higher than 105° at any time the child rarely recovered. The temperature generally rose several degrees after operation, but it was of no significance unless, as pointed out by Ripley,[1] it remained high, when it could be inferred that the disease was progressing unfavorably. But a marked rise on the third, fourth, or fifth day after operation was the most ominous sign and generally ushered in a fatal result. In the majority of cases the temperature ranged between 99° and 103°.

The treatment in all these years has, of course, varied very much. Of late years the steam pipes in the tracheotomy rooms have been tapped, and for several days after operation every child lies in a cloud of steam coming from these pipes. In former years a hand atomizer was used. Free stimulation and milk *ad libitum* form the treatment of nearly all cases after operation. 66 cases were treated with mercury in small and frequent doses ($\frac{1}{60}$ of a grain of corrosive sublimate or $\frac{1}{4}$ of a grain of calomel every two hours), and the recovery per cent. was 28, and did not differ materially from the recovery per cent. of 156 cases which were treated by steam, brandy, and milk, where 40 cases, or 25 per cent., got well. Quinine was given through the course of the disease in 53 cases, and the recovery per cent. here was 39, much larger than in the other cases mentioned above, but the numbers are altogether too small to warrant any conclusions as to the comparative efficacy of different methods of treatment.

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[1] Ripley: Med. Record, Jan. 24, 1885.

In turn, ipecac, lime-water spray, chlorate of potash, iron, pilocarpine, pepsine, etc., have held the chief place, but the number of cases in which each has figured is too small to be worth analyzing, and iron, quinine, and mercury hold the chief places. In connection with the mercurial treatment, it should be mentioned that an excessive flow of saliva is an occasional accompaniment of laryngeal diphtheria. This was noted in several cases in which mercury was not used at all, and for that reason the drug is probably credited with much salivation for which it is not accountable. In the same way diarrhœa, many times noted after the continued use of calomel in $\frac{1}{4}$ grain doses, often came on where no mercurial had been administered. Young children took $\frac{1}{60}$ of a grain of corrosive sublimate for two or three days, and within that limit they were rarely salivated, and still more rarely did they have diarrhœa. If it was continued longer, or if it was given in larger doses, it was apt to cause one or both. Calomel, on the other hand, was likely to cause diarrhœa, if used even moderately.

When a patient progressed well, on the fifth, sixth, or seventh day the neck tape was cut, and the tube was taken out quietly, without any preliminary testing of the larynx by stopping the tube. In 65 cases of the 95 which recovered, the tube was finally removed by the eighth day (once on the third day, and twice on the fourth), and was not replaced. In 9 cases it was necessary to put back the tube within a few hours of its first removal, and to leave it for a few days more, on account of the difficulty which the child experienced in breathing without the tube. In 4 others it had to be replaced a second time, but it was not worn more than a month altogether in any one of them, while in 4 others it was impossible to remove the tube definitely for periods varying from 3 months to 3 years. These four cases have been reported elsewhere.[1] This difficulty in getting the children to breathe without their tubes at the usual time for so doing did not seem to be due to any unusually early or late time of the first attempt at removal. In most of them, as in the others, the attempt at removal was made on the fifth, sixth, or seventh day, and not until the dyspnœa began (usually some hours after the tube was taken out) was there any indication that matters were to go wrong. These were average cases in every other way.

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[1] Lovett: Boston Med. and Surg. Journal, July 22, 1886.

Diphtheria of the wound was noted in only 6 cases in the 327; 3 of these recovered. In 2 other cases diphtheritic membrane appeared, once on the ear, and once on the lip.

17 times the tracheotomy was done for croup (mostly diphtheritic in type) occurring during the course of the exanthemata, mumps, or whooping-cough. In 10 cases it was a complication of measles, and of these cases 5 recovered. A very unusual state of affairs, if we may believe Cohen,[1] who says, "Croup supervening on the exanthemata is not, as a rule, amenable to tracheotomy," and Settegast[2] says "Cases of recovery are so rare as to be mentioned individually." The other 7 cases after mumps, scarlet fever, and whooping-cough were all fatal.

The amount of nourishment taken by a patient indicated, of course, in a general way the progress of the case. The children were encouraged to take as much milk as possible, and in many cases were fed every hour. They took from 20 to 40 ounces of milk a day, 30 was a fair amount, and when a child took less than 25 it rarely recovered. Milk came out through the tube and wound in some cases, but it was no very serious matter, for in 7 cases when it was noted, 5 recovered. There were many curious complications in all these cases, but those of practical interest have already been mentioned.

The results of operation in this series of cases are above the average, in spite of the predominance of bad cases. They show that young children are especially liable to have extension of the diphtheritic process to the bronchi and lungs; in fact, that the chances are three to one that if they die they will die of suffocation. That, in Boston, tracheotomy at the hospital is most fatal at those times when diphtheria is most fatal in the whole city, and incidentally that the mortality per cent. from croup and diphtheria in the whole city vary by the month in unison. That cases with membrane in the pharynx at the time of operation are more likely to die than those where it is not present. That the mortality per cent. after tracheotomy rises steadily as the operation is done on the first, second, third, or fourth day of the difficult breathing. That nasal discharge, albuminuria, and enlargement of the cervical glands, are symptoms of less moment than the character of the discharge from the trachea tube, which is the most important index of the progress of a case, and that the recovery-rate varies nearly 50 per cent. between cases where the discharge is loose throughout and those where it is gummy at any time.

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[1] Cohen: Croup in its Relation to Tracheotomy. 1874.

[2] Settegast: Archiv für klin. Chir., xxiii. 270.

For purposes of comparison, a table of all available reported cases of tracheotomy has been constructed. As a rule, no group of less than five operations has been considered, very few contain less than ten, for the reason that recoveries predominate enormously in the very small groups. The journals are full of accounts of two or three successful cases reported by practitioners who may or may not hint at various failures in the past. It was considered that to count such groups would be misleading, and they were all rejected, whether favorable or not, because they were not considered representative. The cases are arranged by countries, and, so far as it has been possible to tell, no cases have been reported more than once.

	Total.	Recovered.	Died.	Per cent. Recovered.
German authors	5795	1851	3944	31
German hospitals	3063	939	2124	30
British authors	433	138	295	31
French authors	9242[1]	2242	6834	24
Various countries	1993	657	1336	32
American authors	1327	308	1019	23
	21,853	6135	15,552	28

[1] 166 not healed.

REVIEWS.

The Science and Art of Obstetrics. By Theophilus Parvin, M.D., LL.D., Professor of Obstetrics and Diseases of Women and Children in the Jefferson Medical College, Philadelphia, and one of the Obstetricians to the Philadelphia Hospital. Illustrated with two hundred and fourteen woodcuts and a colored plate. Pp. xv. 701. Philadelphia: Lea Brothers & Co., 1886.

There is always room for a good book. The more thoroughly beaten are the paths, the more familiar each commanding feature of the landscape, the better welcome to one that can picture anew the familiar scene, and throw upon it broader lights or bolder contrasts. But where so many know, and so many have described it, all the more difficult for one to enter upon the field. He must expect criticism. No two see the same well-known object from the same point of view. The perspective angles are all different. In the great field of gynecic literature obstetrics seems to stand still. It is not still, however. It has the advance that is made all along the line, and has seemed to move less rapidly in contrast to the brilliant progress of gyniatrics.

There is enough of the new to signalize the advent of a new book in obstetrics, and it is a graceful act in Dr. Parvin to mark his translation from his old field of work in the West to one of broader, more ardent labor in the East by an elaborate treatise upon a subject that he has made his own, and won an honorable fame.

His task has been a difficult one, and to which he must have been impelled by a higher motive than ambition. We needed the book, not in the sense of lack of quantity before the medical public from which to select, but American literature upon obstetrics is not yet rounded out and complete in all its proportions. Dr. Parvin contributes much to complete the structure, and we may now begin to say that we have upon the subject a national literature. Upon a science so broad as obstetrics it may be difficult to define how, in any sense, it can be national in character. This is no place to discuss the matter; but the literature upon that or any other subject may be of such a broad and original character as to afford a consensus of opinion that is truly national. We may go even further, and assert, without danger of inviting contradiction, that environment and social condition may exist as prime factors in modifying to a degree equal to national characteristics many of the phenomena of that science called obstetrics.

Dr. Parvin begins his treatise in the good, old classical way of grounding his readers in elementary anatomy and embryology. A departure from this order would, by some reviewers, be regarded as an innovation. but we believe that some obstetrical author of the future will thus innovate. It is perfectly proper to regard the young obstetrical reader as being in need of some special instruction concerning the female pelvis and its contents, but one must be careful not to do the young reader harm rather than good. Dr. Parvin takes a cut from a plate by Sappey of the situation and relations of the uterus, in which the uterine axis is made to conform to the axis of the upper pelvic strait, except that the uterine fundus is slightly posterior to the line of the latter. As usual in this time-honored illustration the bladder and rectum are in a distended condition. The reader may protest against the notice of such a trifle, but it is not by any means a light matter. The mass of students and practitioners have not original and costly monographs within reach to correct an error of this sort, especially as all the text-books upon diseases of women in English, with one honorable exception, reproduce an illustration of the same general character. The reviewer well remembers that once upon a time, while giving evidence upon the stand, an unfriendly advocate held Playfair's very good book under his gaze with this same cut, or one like it, uppermost, and asked him if that was a correct illustration of the natural relation of the pelvic viscera. "No, sir, it is not," was promptly answered. "What!" with a triumphant glance at the jury, "do you differ from this distinguished English authority, and from Dr. A., and Dr. B., who have just sworn that this is a correct representation of these parts?" Surely this advocate could not be blamed, nor could Dr. A., or Dr. B. But we must confess to a certain degree of feeling toward Playfair, who knew better, and one may fancy that the well-executed woodcut in Parvin will serve the same ignoble end. Our author still further confuses his younger readers by giving an approximately correct pelvic section copied from Schultz, without a word of comment to guide the reader to a correct conclusion. The two opening chapters devoted to the subject already noticed are well illustrated, and compiled from the latest authority. We notice but one omission, and that is the correction of Hart, as to the distribution of mucous membrane upon the nymphæ and body of the clitoris, which differs materially from accepted descriptions, which independent study by others has confirmed.

The third chapter upon puberty, ovulation, and menstruation is interestingly written. At the outset our author expresses himself in a way that one choice in the use of terms would object to. Incidentally he defines menstruation as a hemorrhage from the uterus that occurs at definite times, concerning which, we all know that menstruation in its normal expression is not a hemorrhage. Justice requires us to admit that he does not use the term in its exact sense, but in an illustrative way; in other words, it is a figure of speech. While upon the use of terms it would be as well here as elsewhere, to speak of the style of our author. Nothing in the way of medical writing can be more clear or simple. Most medical writers, unless they are stricken by Hugo or Carlyle, cannot be said to have any style; but concerning our author, if we were to apply to it the standard of old Hugh Blair, simplicity is the only term to convey an idea of the directness of expression, the freedom from ornament, and the painstaking effort to avoid confusion of expression. We fail to recall an instance in the book in which he has tried to clear up a doubtful meaning by turning the idea into another expression, which is a very common fault in text-books. Another feature that will strike the reader is the careful way in which excessive technicalities have been avoided. Our author has a correct idea of a technical word. Its proper use is not to convey a meaning but to give a definite form to an expression. Its use is to limit and so direct the sense that but one construction, and that sharply defined within the limits of a single word, can be placed upon the sentence. As an instance, but not specially to illustrate the last comment above, take the following:

> "The physician, whose duty is not only to heal the sick, but also to prevent disease and to improve the race, and hence one (who) must be a teacher of men and women, should teach sound doctrine in regard to the injurious results of precocious marriage. Mothers especially ought to be taught, though some have learned the lesson by their own sad experience, that puberty and nubility are not equivalent terms, but stand for periods of life usually separated by some years; the one indicates capability, the other fitness for reproduction."

It would have been a blessing, not in disguise, if the text-books written according to law to teach physiology in the common schools of New York, could have been expressed in such direct and simple English. One will notice the omission of pronouns, which is almost a mannerism of the author, which seems to come from his desire to construct a sentence without a superfluous word. On the following page, what can be more simple, exact, and graphic than the following description of the *corpus luteum?*

> "The ovisac—its size lessened by the escape of the ovule and its surrounding granular matter, and of serous fluid, and the rent through which these passed closing—undergoes certain changes, which result in its obliteration, the most notable of these being the formation of the *corpus luteum*, or yellow body."

Would the young reader of that ever forget the cause and nature of this little spot? Neither our author, nor the reader must put a wrong meaning upon what our sum total of his style amounts to; it is complimentary, not invidious. It is this, by way of comparison; Lusk's treatise is one for the mature practitioner; Parvin's for the student or undergraduate. Not that one is more elementary than the other, but one is better fitted by happy simplicity of expression to convey an idea,—to break the ground, as it were, in the process of education. The result is that we know of no book that comprises a greater mass of facts within seven hundred pages than the one before us.

Upon menstruation, concerning the nature of which there are some well-grounded uncertainties, if such an expression can be allowed, our author permits no liberties. If he has any pet theory of his own, he evidently regards an educational treatise as no place for its exposition. In one sense he is right, but he must not forget that he is a guide as well as an educator, and that even a word of doubt or dissent is a useful stepping-stone to the truth.

Part second opens with the subject of pregnancy, of which the first chapter is given to conception, early development of the impregnated ovule, formation of deciduous membranes, and the fœtal appendages, and gives us a *résumé* of the latest theories.

The second chapter is devoted to the anatomy and physiology of the embryo. Very properly the author insists upon the distinction between fœtus and embryo which is so frequently confounded. Dr. Parvin adheres to Pajot's law concerning fœtal presentation. He says:

> "Studying Pajot's law as it relates to the presentation alone, we find in the painless contractions of the uterus in pregnancy, in the varying abdominal pressure, and in the changes of position of the mother, which have more or less action upon the fœtus, the conditions of movement and rest; the fœtus

presents more of a rounded than an angular surface, and after the secretions of the sebaceous glands begin, this surface is smooth, slippery, and thus the amniotic assisting, the accommodation of the contents to the container is effected. This accommodation fails in those months of pregnancy when the uterus is very much larger than the fœtus. Thus Veits's statistics show that in 247 deliveries between the first of the fifth and sixth months, the head presented in 140, the pelvis in 95, and the trunk in 12. In the fœtus be dead and macerated, one of the conditions of the law fails, the content is no longer a solid body, and statistics show that in very nearly one-half of the cases when delivery takes place before six months the pelvis presents."

Many corroborative facts can be brought to bear upon the quite general utility of Pajot's law. Presentation of the pelvis is common in the hydrocephalic fœtus and evidently in obedience to the law of accommodation. In twin pregnancies there is a defect in this, with corresponding variations in errors of position. In hydramnios the law of accommodation is violated, so that breech and lateral presentations are common.

The author refers to the discussion in the New York Obstetrical Society of fœtal narcotism secondary to that of the mother. The matter must now be regarded as beyond dispute. Porak's experiments are absolutely conclusive. In one instance in which one grain of quinine was given to the parturient woman, the urine of the child born an hour and a half afterward showed the presence of the drug. Ruige made a similar observation. If the child in utero can suffer from intermittent fever the remedy is at hand.

The third chapter is devoted to changes in the maternal organism and to multiple pregnancy. Concerning the latter, our author adheres to the possibility of super-fecundation in the human female, adducing the familiar illustration of the white woman with twins, one white, the other a mulatto; or its converse, the black woman with a white and a mulatto child. It appears to us much more reasonable to regard them as instances of atavism, which is so very common in cases of mixed blood. At least in all phenomena of this nature the contrary of mixed races must be proved before we can offer superfecundation as an explanation. The latter aberration of fecundation is no more marvellous than that of superfœtation.

The fourth chapter upon the signs and diagnosis of pregnancy is very compact, and well written with no long exposition of the various signs, and is an excellent chapter for the student. The author's MS. was so far out of his hand at this point that he evidently could not include Hegar's sign of pregnancy, one of the very last of any value.

In the fifth chapter the author enters largely into the medico-legal aspects of the duration of pregnancy, the proof of previous pregnancies, and missed labor. At the conclusion of the section he gives a summary of the legal bearings of the duration of pregnancy by James I. Baker, Esq., of Indianapolis, which is the best exposition of the subject to be found in any text-book up to the present time, not excluding even treatises on medical jurisprudence, as it is a statement of decisions in the various State courts. Mr. Baker's brief upon the subject will evidently find a permanently useful field in the literature of this vexed question.

The management of pregnancy, the pathology of the condition, and eclampsia, are the subjects of Chapters VI., VII., VIII., and IX. Relating to the latter, the author alludes to the quite recent studies of

Doléris and Butte. They have found toxic ptomaines in the blood of eclamptics, which may cause the disease. If this view of the origin of the convulsions is confirmed by future investigations, we may put to one side the exclusive idea of renal origin. It is to be regretted that our author is so non-committal upon the treatment of eclampsia. In this grave accident the student needs an energetic guide. It is not so much a single question as to what is safe and that only, but what can be done that is not more dangerous than the disease itself? For instance, our author's most hearty approval of bloodletting is, that "the abstraction of blood gains time for the use of other therapeutic means, and prevents the consequences of congestion; the abstraction of ten to fifteen ounces of blood can only, in exceptional cases, be immediately or remotely injurious." Our friend, Dr. Clark, of Oswego, in his energetic use of morphia receives no word of favorable comment, although it is a practice that is gaining ground, and giving excellent results. The author leans to the free use of chloral, a drug that is certainly as potentially dangerous as morphia.

In Chapters X. and XI. diseases of the sexual organs and of the ovum are described. The only point necessary to call to the attention of the reader is the author's method of dealing with retained placenta after abortion at the third month. He is conservative and cautions against too active interference, quoting approvingly Churchill's conclusion, that they may be safely left to nature. There is surely no danger in proper removal of placental fragments, and the sum of opinion in this age of clean surgery, not to say midwifery, is in favor of removing all sources of septic infection. Surely, of all organs of the body, and of all material that may become incarcerated within it, no one is so prone to absorb, and nothing is so certain to decompose, as a uterus with retained fragments. That we do remove them days after the proper time for expulsion, filthy beyond description, and the woman show no evidence of blood-poisoning, is no argument to leave these cases to nature. Cases have came to the writer's knowledge in which the retained mature placenta was treated in the same Fabian method. Now, as a matter of fact, women do not often die from blood-poisoning due to decomposing placental fragments after spontaneous absorption, and it is upon this tolerance that the treatment by non-interference is based; but they do in some instances die, and there is a special liability to this result in instances of forced abortion, so that it is doubtful policy on the part of an educator to be conservative in his teaching upon this subject. If placental tissue, either in fragments or entire, is left longer than ten or twelve hours it is sure to be decomposed, the result of bacterial invasion; and the line of non-interference ought to be drawn about them as a matter of time Dr. Parvin may be right as a teacher to deprecate the use of the curette and other instrumental interference when the case presents no evidence of danger. The method he advises, that of the finger, is a safe and efficient one, but in case the cervical canal is closed, so that the finger cannot be introduced into the uterine cavity, as it very frequently is after twenty-four hours, it is not necessary to resort to gradual dilatation, as the author advises, with tents, but rapid dilatation is safer and better, and may be almost painless with a proper instrument and gentleness in manipulation.

Chapter XII. is devoted to the study of ectopic development of the ovum and placenta. A concise but excellent summary of the symptoms of the former condition is given. The treatment by the faradic current is assigned an important place in the treatment. It is to be regretted that more exact rules for the application of the current to arrest fœtal life are not given. Garrigue's directions, that a moderate current for ten minutes at a time be employed, are of very doubtful utility. The writer has just been through an experience of this kind, and the method of Garrigues as quoted by our author would have been useless. It needs no argument to assert that the faradic electricity is used to destroy life. The fact that this life is of low grade does not imply that it will succumb to a mild form of the agent, passed for a short time. Fœtal life, to illustrate, is of as active a nature as that of vegetable life, and it is known by experiment that in the majority of instances a powerful current is needed to cause fatal molecular changes in the latter. Another fact, which every one who has used faradic electricity about the female pelvis must have noticed, is the great tolerance to the current in these parts. In one instance under the observation of the writer, the full strength of a large induction coil, with a current from two zinc-carbon cells, was used with but little expression of pain from the patient. It was impossible for the operator to hold the electrodes in his hands. A secondary current of this strength was passed through the fœtal cyst for an hour. Several séances of this character were had before it could be said that fœtal life was destroyed.

A word as to the evidence that the current has done its work. This ought to be looked for in the cyst rather than to abatement of the rational signs of pregnancy or to retrograde changes in the breasts. The most important are lessened tension in the cyst, which is observed long before the most delicate touch can assure the operator that there is actual diminution in size. The situation and character of the cyst are such that no manner of touch can measure it, it simply leads the observer to exert a scientific imagination that the cyst is diminishing. Next, the attacks of pain ceases. This will be noticed to coincide with the lessened tension of the cyst wall, and is probably due to the relief of pressure upon tissues but little tolerant of tension, and with but scant time to acquire adjustment to the morbid change. It is to be regretted that there is no accurate method of measuring the strength of the secondary current of an induction coil; if there were, it would be a very simple matter to designate the electro-molecular force necessary to destroy fœtal life in ectopic pregnancy; but in the absence of such a guide the writer would urge a strong current and a long séance.

At Part III. the author begins the study of labor. Eight concise, well-considered chapters dispose of the whole subject, which is given further value by a profusion of well-executed wood-cuts. Our author presents nothing new in the division of his subject. Abdominal palpation is well described and illustrated as it is now in all the recent handbooks. We have great faith in instruments of precision and of their influence upon the future of medical science; but it is quite an innovation on the general conservative tone of the book to have our author give the very ingenious instrument of Dr. Deaman, called a parturiometer, a very prominent place and give a few lines of comment rather unfortunately expressed. He says:

> "The parturiometer indicates when it is proper to break the membranes, when the cervix is fully dilated; when the application of instruments becomes necessary."

There must certainly be something in Dr. Deaman's instrument that will cause such a statement from our author. We had supposed that in all the above indications the "when" was more or less of an intellectual process, and while instruments of this character are useful they will rather serve the purpose of exact study of phenomena than take a practical place at the bedside. Dr. Deaman contributes a page of description of his instrument which is very interesting.

The author enters fully into the subject of anæsthesia. In this period of multiplicity of agents of this character chloroform is given the chief place. It is evidently Dr. Parvin's practice to employ it, although the reader gains this idea by inference rather than directly. Chloral in the first stage of labor is mentioned, and probably serves as useful a purpose as general anæsthesia in the second. It is surprising how slowly anæsthesia in obstetrics has gained its place, and it is far from being in general use to-day. The writer must confess to having had a great reluctance in using it early in labor, and confined its use to the expulsive stage; but just before withdrawing from obstetric practice it was resorted to in every case, affording deep regret that for fifteen years he had given it but little use. It will certainly become generally employed when such a conscientious teacher as Dr. Parvin advises it.

A great variety of statements from various authors is given concerning the care of the perineum, and the student must be left in considerable doubt as to the better way; a careful reading leads to the opinion that it is the author's practice to support this part during the expulsion of the head. Chloroform is a better protection than the methods of support given in the text, as an anæsthetic prevents the energetic voluntary efforts on the part of the mother.

Immediate ligation of the cord is advised; or, at least, what the advocate of late ligation would call immediate. He says, "when the child breathes freely, and the pulsation lessens in force, one need not wait. In regard to waiting until all pulsation has ceased, one might, in some cases, wait until all patience as well as pulsation has ceased." None but the ardent advocates of late ligation can object to this. It will afford comfort to mothers and old nurses to know that the "belly band" is advised in dressing the child. It cannot possibly do any harm to apply a bandage properly to the abdomen of a newly born child, and yet it is a recent "fad" to leave it off. The binder to the mother also finds a consideration at our author's hand, and young practitioners had better follow the advice. It is a proper and comfortable article of dress, and ought to be so considered.

The chapter upon anomalies is contributed by Dr. Henry Morris, and is well written and illustrated.

The puerperal state is considered in Part IV., and is the shortest division of the book. We will omit all review of this section, except that which relates to puerperal septicæmia. Whatever may be the debt of surgery to antiseptics that of obstetrics is equally great, and a teacher of the latter must now occupy no doubtful position concerning the sources of puerperal sepsis. We can find no fault with our author in this. He speaks judicially, but positively:

> "Independently of all culture experiments and inoculations, and microscopic examinations of the uterine and vaginal discharges of sick women in childbed, and of fluids or solids of women dying of puerperal septicæmia, there are some reasons which make it very probable that the infectious agent is a

living, a *contagium animatum,* rather than any chemical substance, whether sepsis or ptomaine. These are, the very minute quantity which infects, the rapidity of its action, and, finally, the protective power of germicidal solutions. It is only upon the hypothesis of a living poison with the great rapidity of reproduction which low forms of life have, that we can readily explain the fact of dangerous illness being so soon developed. And again, if we cure by using injections of corrosive sublimate, or of carbolic acid in solution, it seems more rational to conclude that the agent has destroyed living rather than rendered dead matter harmless. Moreover, the demonstrated dependence of many other diseases upon germs makes it probable that this also has a similar cause. . . . .

"The microbes which are most constantly found in puerperal fever are chain-like micrococci, and in many cases of the disease where these were not discovered it is possible they were still present, but methods of examination failed. Similar micrococci have been found in erysipelas, scarlatina, and in diphtheria, but similarity does not prove identity, and it may be that careful culture experiments will show that which the microscope has failed to do, an essential difference in these cocci. We must remember that microbiology is still in its infancy, and the relation of microörganisms to disease only begining to be demonstrated, and therefore we are willing to admit that the chain of evidence is not yet complete which connects puerperal fever with the action of microörganisms. Conceding this origin of the disease, are there different microbes for the different varieties of the disease? Or do differences arise from the quantity introduced, and the receptivity of the subject, and the time of introduction? A plant does not thrive equally well upon different soils, nor seeds germinate with equal rapidity in all seasons, and why not admit equal results in microbicum maladies? Scarlet fever in different epidemics and in different subjects, presents grades of intensity and degrees of danger widely separate, yet the poison is one and the disease is one. The origin of an epidemic of puerperal fever may be in a case of retained placenta where means have been employed to remove the placenta, these means failing to make the delivery complete; in a day or two the lochia become offensive, the woman has a chill followed by high temperature and increase in the frequency of the pulse. Other women are infected from this patient with different forms of puerperal fever, scarcely two presenting the same symptoms. Here then is a common cause, but various results; one fountain, but many streams.

"But what *rôle* do retained clots, or as in the instance just alluded to, do fragments of placenta play in the genesis of the disease? Are they innocent, so that it is a matter of indifference whether they remain in the puerperal uterus? No, for while they do not create the disease they furnish the nidus in which septic germs enter, a favorable soil for their development and multiplication.

"*Summary.*—From what is known of so-called puerperal fever it should not be regarded as a specific disease, and strictly speaking there is no puerperal fever, that which is so denominated being a febrile affection caused by the entrance into the system of a poison from without, the nature of which we do not know, the entrance taking place through a wound of the uterus, or of some part of the vulvo-vaginal canal."

No honest bacteriologist can take exception to this well-expressed summary of Dr. Parvin, or to any portion of the above. It is one of the best expositions upon the subject in any text-book, and will produce a healthful mental impression upon students and practitioners. To those who are fond of a well-turned sentence we hold the following up as one of the cleverest in medical literature. We have already quoted it, but it will bear repetition. "It seems more rational to conclude that the agent has destroyed the living rather than rendered dead matter harmless." It is the gospel of disinfection, and the whole creed of the bacteriologists; but it provokes the reviewer into saying that it is a great pity that a man who can express a conviction so fairly and so happily has not thrown authorities and their conflicting dogmas to the winds and become Parvin himself from cover to cover, as he was so well able to do. When will some American treat the subject of obstetrics as Emmet has that of gynecology, and not like Lusk, who has written the best German work on obstetrics in the English language, or like one not yet upon the shelves of our library, which is the best digest upon the subject up to date.

We are not yet through with our author upon the subject of antiseptic midwifery. Now with the author's clearly expressed views upon the subject of puerperal infection before us, we are prepared to say that prevention is of much greater utility than treatment. In fact, what physician has not the misfortune of knowing how useless are some, if not all, of the best laid plans of medication, and even disinfection, in the presence of this disease? We have seen how fully in line with the most advanced writers Dr. Parvin is upon the subject of antiseptic midwifery; but as in this practical part of his treatise we have to consider methods not opinions, let us inquire how perfect are his methods for the protection of the lying-in woman. Turning back to his chapter upon the conduct of labor the author says:

> "Thorough disinfection of the room which the patient is to occupy should be made, if it has been previously occupied by one suffering with scarlet fever, with erysipelas or diphtheria, or with any disease attended with suppuration, as uterine cancer in its advanced stages; it would be better, indeed, for her lying-in to be in another house, or other room. The room, too, should be free from the effluvia of decaying animal matter. If there be any sewer communication in it, as, for example, from the permanent wash-stand, that communication should be for the time, at least, cut off. The obstetrician must know that the nurse has not recently been in attendance upon any of the forms of disease that have been mentioned and especially upon a case of puerperal septicæmia."

This is all very well and no possible exception can be taken to it so far as it goes; but the best comment we can make upon it is to quote from a recent paper by Prof. William D. Richardson, of Harvard, published in the *Boston Medical and Surgical Journal* for January, 1887. He is writing upon the use of antiseptics in obstetrics, as illustrated in the Boston Lying-in Hospital:

> "The various changes which have been in the attempts to rid the hospital of septicæmia, have been the results of careful study and observation on the part of the visiting physicians, and after many anxious consultations on the subject. As one septic case occurred after another, every effort was made to avoid any possibility of contagion from a patient presenting symptoms of septic infection to another. Isolation of suspected cases; the employment of extra and special nurses, the assignment of different house-physicians to the infected, and to those whose convalescence seemed normal; the use of every possible precaution to insure cleanliness, the providing of individual bed-pans, syringes, etc., constant attention to ventilation and improvement in the drainage, were among the methods adopted. Many of these changes seemed to promise improvement, which, however, was always found to be temporary. From the very outset the staff were a unit in the belief, even then not generally accepted, that the views of Semmelweiss were correct, and our object was to prevent the entrance of septic material from without, and the prevention of the absorption of septic material originating within the uterus and generative tract. With this latter end in view, we soon began the use of vaginal injections,

> hoping to keep disinfected those parts especially exposed to the lochial discharge, which seemed to us one great source of danger within the patient herself. These were subsequently not infrequently combined with intra-uterine injections, hoping thereby also to render innocuous the clots and placental débris within the uterine cavity. All these attempts proved futile, although occasionally it did seem as though some new method of procedure which we adopted was at last to offer the long sought for relief. The respite was, however, only temporary, and still the mischief went on.
>
> "In the middle of the winter of 1883 and 1884, corrosive sublimate was first tried, not only as a vaginal douche but also for the disinfecting of the hands of the attendants. A very decided improvement followed this method of procedure, and again the outlook was more cheering. Still septicæmia remained with us, but in a more modified form and the death-rate fell decidedly. Then came the announcement of Robert Koch's investigations of bacteria, and . . . . we determined to change our whole system."

We will now return to our author and continue the quotation from the next paragraph to the last on the conduct of labor.

> "It is well for the parturient to take a warm bath at the beginning of labor, and afterward to have the external genital organs washed with a two or three per cent. solution of carbolic acid; when the labor is protracted, a similar solution may be used as a vaginal injection once or oftener. A three to five per cent. solution may be used by the physician, and by the nurse for washing their hands. The former not only should use an antiseptic solution in which he washes his hands before each examination, but also an antiseptic ointment applied to the fingers before introduction into the vagina; this may be carbolized cosmoline, or iodoform and cosmoline, or an ointment may be made by incorporating with an ounce of cosmoline, one-tenth part of thymol."

As the latest expression upon this vastly important subject of antiseptics in labor, and to contrast the very material difference in methods, we will introduce one more extract from Prof. Richardson. It relates solely to the conduct of labor.

> "In every case the genital and surrounding parts are washed with a solution of bichloride of mercury ($\frac{1}{3000}$). A basin containing the same solution and a nail-brush is placed on a stand by the side of the bed. The physician and nurse in attendance disinfect their hands every time they have occasion to examine the patient or touch the neighborhood of the vulva. The examining finger is smeared with an ointment made of one part of the oil of eucalyptus and seven parts of vaseline. A vaginal injection of the corrosive sublimate solution is given at the beginning of labor, and this is repeated when circumstances permit at the end of the first stage. As the head distends the perineum and is expelled the parts are kept clean by the use of charpie dipped in the mercurial solution. After the birth of the child, no undue haste is made to bring about the expulsion of the placenta. This is effected, if possible, by Credé's method of expression, great care being taken not to introduce the hand within the vulva, if such a procedure can be avoided. The original injection is repeated, and the antiseptic pad is applied."

It is by such means as the above that the dark picture of septic infection has been changed and lighted up. It proves that infection comes from without; that its introduction can be prevented, and that, as a prophylaxis, it is as complete as vaccination is to smallpox. Contrasting the two extracts, it shows that our author is right, and that he believes in the best teachings of the bacteriologists; but his methods are doubtful. A two or three per cent. solution of carbolic acid has been demonstrated to have no more value as a germicide than clean water.

But we do not bring this up as a critical matter. Our author is treating antiseptic midwifery, and anything that would lead the student or practitioner into the false security of half measures is a fault equally as great as not to teach it at all. This is a practical matter. Opinion has nothing to do with it. Demonstration has made it clear as the sun at noon-day, and it is therefore a question of methods, and those methods by which the most perfect results have been attained are those which ought to be taught. The opinion that one may have, that one procedure is as good as another, has nothing to do with it if the two methods have not been put to equal tests. There is a certain moral responsibility in teaching that reaches such a high level that one may try in vain to attain it by the force of opinion. He reaches this altitude by facts, surrounds himself with them as with an atmosphere, and lifts up to his own level all who follow after.

The author resumes the subject of antiseptics in describing the treatment of puerperal septicæmia in which further prophylactic measures are followed in the convalescence, while his remedial measures are of an active antiseptic nature, and in all of which he is in accord with the best teachings. In all that has been said of a critical character above we wish in no way to detract from the real value of this important section of his book. In fact, it may be said to be in advance of any recent text-book; but since the latest American text-book very material advances have been made upon this subject, and the practitioner to be properly instructed should have a practical knowledge of the best methods of maternities in order to judge how perfect he must make his antiseptic details at the bedside.

The fifth and concluding part is devoted to obstetric operations, beginning with the induction of abortion, premature labor, and turning. The latter is presented in accordance with the precepts of Dr. Samuel Sloan. The instructions as to turning are very simple and practical, and will serve to do away with the fears of the young practitioner lest he gets hold of the wrong foot.

The forceps are studied in the second chapter. There is a well written history of the instrument, illustrated with cuts of the older and later forms, followed by the theory of the forceps and the mechanical principles involved in their application as levers, tractors, and rotators. Chapter VIII. disposes of the indications for the application of the forceps and the rules governing their use in general, followed by special instructions in different presentations and positions. This chapter is one of the most practical in the book, and too much praise cannot be awarded the author for the simple and clear manner in which this usually difficult subject is disposed of. The application of the forceps is so simply and clearly described that the least learned practitioner can understand it. It is not always so, as a very recent instance will show, in which a New York reviewer got so tangled up with his author that he could not understand whether he meant the right or left thigh of the mother, or his own right or left hand. We read and reviewed the same description and thought it a very good one; but as the reviewer was a very learned man, we always thought it was stupid on our part not to confess to an equal degree of confusion.

Chapters IV. and V. conclude the book, and are devoted to the subjects of Embryotomy and the Cæsarean operation and its substitutes. The latter will alone detain us. At the opening of the chapter we are startled by a table compiled by Dr. Harris showing the strange fatality attending this operation in the United States; no mothers saved here, while in Germany, 84 per cent. of the mothers were saved (25 operations, 4 deaths), in the past year.

> "Leopold operated for the tenth time in June, 1886. This gives him the loss of one woman in ten, or from his hospital, a saving of ten women and three children from eleven operations. Now if such success could be obtained by practitioners generally, craniotomy upon the living fœtus would soon become unknown."

It is not a little singular that after various improvements in the operation, we have as the best method of operating, returned to the so-called improved Cæsarean operation, which is the old way of operating, nothing more. It is simply done more carefully, with more hope in it. In one operation, we remember hearing one of the physicians present urge the operator to take less time to clean the abdominal cavity as the woman would die any way; and that seems to be the spirit in which the operation is often made. Now, the improved operation, as described by our author, who follows Potacki, is simply the old operation made with more care, as to suturing the uterine wound and antiseptic precautions.

Porro operation and the Porro-Müller modification are next considered, and contrasted with the Cæsarean. Up to 1885 it does not offer as good results to mother and child as the latter.

> "Up to March, 1885, fifty per cent. of the mothers recovered after the Müller modification, and forty-four per cent. after the unmodified Porro." "There are," the author continues, notwithstanding this greater success of the Cæsarean operation, "instances in which the Porro or the Porro-Müller would seem to promise the greatest success. When, through unwarranted delay, or by reason of unwarranted attempts at delivery the uterine tissues have been seriously injured; or when the child is putrid, or when the patient is greatly exhausted with incipient or established septicæmia, the amputation of the uterus and its appendages by the Müller method would seem preferable to the Cæsarean section; again, when there is extensive fibroid or fibro-cystic degeneration of the uterine body, an amputation at the neck would be indicated. Whenever there is especial reason to fear septicæmia, the Müller modification should be preferred to the Cæsarean section without amputation."

It is difficult to understand why in case of septicæmia Müller's method should offer better chances when we consider that the chief cause of death after Porro was from blood poisoning, while exhaustion has been the most frequent cause of death after Cæsarean section.

Gastro-elytrotomy is given a short notice with a valuable historical paragraph. Dr. Parvin says:

> "Even if the general success of the operation could be made equal to that which Skene has had, saving three mothers and three children in four operations, this by no means equals that which may be hoped for from the improved Cæsarean operation. Moreover, gastro-elytrotomy is impossible in many cases in which the other method of delivery can be employed. Its performance is liable to cause injury of the bladder, and it is followed by prolonged suppuration."

A brief notice of the Cæsarean section in post-mortem delivery closes the volume.

We have reviewed the book of one whom we know; we know his thorough conversance with his subject; we know the thoughtfulness of the man, and we know if he had stripped himself of his allegiance to authority and written from his own ripe experience, told in the terse and simple manner of the book before us, he would have produced a better book; not better in the sense of a teacher, but better in the sense of individuality, that pervading spirit within the covers of a book that makes it live for itself and the glory of its author. It is one thing to be a teacher; it is another thing to form opinion for those who come after us. One must elect which he will be. It is a ripe harvest that Dr. Parvin offers to his readers. We are satisfied with his labors, and he has done well. He has elected to be a teacher and as such he has followed in the steps of those who have gone before. He has crystallized the thought that has ripened; he has been a gleaner but has planted no seed for the harvest of the future. But the gleaner has his use as well as the sower of seed and without him there would be an end to all progress. It has been said that one who invents a new flavor is greater than he who captures a city, but how much greater is one who sets all after-coming men thinking.

There is no book that can be more safely recommended to the student or that can be turned to in moments of doubt with greater assurance of aid, as it is a liberal digest of safe counsel that has been patiently gathered. E. V. DE W.

DISEASES OF THE JOINTS. By HOWARD MARSH, F.R.C.S., Senior Assistant Surgeon to, and Lecturer on Anatomy at St. Bartholomew's Hospital, Senior Surgeon to the Hospital for Sick Children, and to the Alexandra Hospital for Hip Disease. 12mo. pp. 460. Philadelphia: Lea Brothers & Co., 1886.

AFTER briefly adverting to the history of joint surgery and demonstrating how it has fully kept pace with the rest of the art, Mr. Marsh shows that this advance has been chiefly due to the gradually increasing recognition of the efficiency of prolonged rest in staying the progress of even scrofulous joint disease, and to the application of the principles of aseptic surgery, which latterly "has produced results which can scarcely be exaggerated in the management of suppuration in joint disease. It is now well known that matter, whether connected with acute or chronic arthritis, may be safely evacuated, with the result that the severe suffering, the prolonged fever, the wide and destructive burrowing, and the formation of sinuses, which were the common rule only a few years ago, can be generally avoided. These results are more far reaching than at first sight they appear to be; for when disease can thus be checked at the outset, and when, should suppuration occur, the complications formerly so constantly met with in connection with large collections of matter can be averted, diseases of the joints become in their whole aspect much less formidable, they extend over much shorter periods, they lead to no material deformity, they cause comparatively little suffering, they inflict but little injury on the general health, while such mutilations as excision and amputation are falling more and more into disuse."

These sentences epitomize the author's theory and practice in the treatment of all forms of joint disease, with, of course, certain minor details, which, when examined, prove only to be modifications—not contradictions—of these rules. Admirable as rest is, beyond all question as are the advantages of, nay necessities for aseptic surgery, yet our experience has taught us, that with every advantage on our side, there yet remain more cases rebellious to perfect rest from their outset than Mr. Marsh is willing to confess.

We shall quote further on some of his extreme views as to the possibilities of rest in all cases, if commenced as soon as joint symptoms appear, and persevered in for years; but in passing we must protest against the teaching—while fully believing in the paramount advantage of rest—that only the very rarest exceptions to the rule of cure will result, if Mr. Marsh's plan be pursued, since this is a most dangerous doctrine both for patient and surgeon: for the former, since he loses faith and unfairly blames his attendant; for the latter, because it lays him open to a prosecution for malpractice.

Mr. Marsh does not believe that all strumous affections are tuberculous because, apparently, of the absence of tubercle bacilli in some cases, ignoring the results obtained both experimentally and clinically by some of the French observers with these non-bacillous cases.

Again—and here most correctly—he points out that joint cases which occur in patients with strumous tendencies are often not spontaneous, but have been lighted up by a traumatism without which no trouble would have occurred, while a mere chronic joint trouble with destructive tendencies is no proof whatever of struma, but is in many cases due to the alleged traumatism from which it started, plus want of proper treatment by rest, etc. All this we cordially endorse. On the other hand, he also apparently believes that there are a certain number of patients whose affections are solely due to the deposit of tubercular products in their osseous or articular tissues.

Holding such views, excisions of joints and amputations of limbs for the prevention of a generalized tuberculosis are only mentioned to be declared unworthy of consideration. Unlike so many of our more pretentious works, this one has been written by a surgeon of ripe experience in special fields, so that we hesitate to differ from him, and yet, do not modern theory, practice, and experience all teach very much to the contrary? Of course, there are exceptions; but according to our view the exceptions are reversed—*i. e.*, what are Mr. Marsh's exceptions we are inclined to think rules, while his rules—with respect to struma, be it understood—we consider exceptions. Perhaps this is too broadly stated, but it approximates the truth.

Mr. Bowlby is credited with the pathological portion of the work, his descriptions having been adopted by Mr. Marsh. In the main, the brief descriptions given are good, but who is responsible for the following extraordinary pathological fact? "The bloodvessels dilate, *fresh capillaries are formed*, the blood-stream is at first accelerated, but soon stasis in many places ensues" (the italics are ours)! Nothing is more certain in pathology than that new bloodvessels do not form at the stage when the blood-current is accelerated, the bloodvessels next dilating, and stasis is only incipient. What the author probably means is, that first there is either contraction followed by dilatation, or primary dilatation of the vessels with accelerated flow, then stasis, then migration of cells, during which preformed capillaries dilate so as to admit so much red blood as to become distinctly visible, and then, perhaps, the formation of new bloodvessels *does* take place, provided cell migration and proliferation advance to the point of forming false membranes or granulation tissue. Equally pertinent criticisms might be made of other pathological statements. We think that either Mr. Bowlby should have been solely responsible, or that Mr. Marsh should have expressed some positive opinion as to his own views, and not have cautiously alluded to all the views held, in the compass of a few lines, and then have left the reader to his conclusions, which must be vague indeed when drawn from such premises.

Speaking of acute synovitis, the advice is given to retain the limb in the position into which the disease has brought it by well-fitting splints for a few days, after which, the rest having removed the muscular rigidity, the limb will naturally subside into a good position. We are glad—while not objecting to the operation—to see that the author warns his readers that aspiration of a joint acutely inflamed is not "devoid of risk." Blisters are highly spoken of throughout the work, but no caution is given against their application over superficial joints. Thus, on either side of the patella between the skin and synovial membrane *very* little tissue exists, and counter-irritation is too often a misnomer, since epispastics, especially if allowed to remain too long, *directly* irritate the synovial membrane. Irritation of the vascular areas *above* and *below* a superficial joint is the better practice, while even the formation of an eschar may be beneficial over a deep-seated joint, as the hip: this is our practice, and general experience has demonstrated its value.

The general impression of the hopelessness of saving a movable joint or even life when acute suppurative arthritis of a large joint occurs is combated, and we are glad to see that the author has proved by results what we have ourselves demonstrated, that free incisions, drainage, and aseptic dressings will often save life and at times a useful joint.

The section on gout should be most carefully read by the American practitioner, who, in general, seems to be possessed by two erroneous impressions, viz., that gout affects only the smaller joints in a first attack; that nothing but port wine and high living can produce gout; and that, in consequence, the disease must be *very* rare here, ignoring the fact that malt liquors in large quantity in those who use but little exercise will develop the disease *de novo*, all the more so if there be hereditary taint. We frequently see the evil effects of this wilful blindness as to the prevalence of latent and at times frank gout in this country.

Again, in rheumatic fever, should suppuration occur, at once the practitioner thinks he has made a mistake and that the disease was pyæmia all along. This may be the true explanation, but when only one joint suppurates the original diagnosis is probably correct. Rheumatic joints are also too commonly considered so safe against displacement as to be unworthy of any special care, but Mr. Marsh avers that in the knee, wrist, and ankle, there is decided risk of displacement and deformity when the disease is persistent.

In an excellent chapter on so-called "Osteo-arthritis," the author shows by a series of brief but admirable pen-sketches, that the condition called by former authors rheumatic gout, chronic rheumatic arthritis, arthritis deformans, etc., and now termed osteo-arthritis, is not a unity but a number of differing diseases which merely present certain resemblances as the ultimate result of their morbid processes. Mr. Marsh uses the term osteo-arthritis as a convenient general heading for a group of diseases characterized by a generally chronic, steadily progressing, painful stiffening, enlargement and distortion of the joints, with destruction of the cartilages, ligaments, and surrounding tendons, osteophytic formations at the articular edges and sometimes in the remains of neighboring tendons. Pathologically consisting of no less than seven different groups, in general terms it is either purely a degenerative change, "or a degenerative process to which a variable but limited degree of inflammatory action is superadded." Although generally chronic, there is an acute form which closely simulates acute rheumatism, although without the profuse sweatings and tendency to acute endo- and pericarditis, but which may in a few weeks seriously damage many joints. In addition, there is another rare form which attacks young subjects—even so young as two and a half years. As there are in reality so many different diseases grouped under this one head, so is the treatment various; but for details we must refer the reader to the original. Hydrarthrosis is looked upon as probably the result of ill-marked osteo-arthritis, and the important fact is emphasized that when bursal enlargement occurs in connection with hydrarthrosis, the bursal sacs commonly open into the joint cavity.

From an extended but excellent chapter on "Charcot's Disease," we shall quote but one sentence: "It is certainly necessary, without falling into the absurdity of finding Charcot's disease in every case of osteo-arthritis, to be on the watch in obscure examples of disease attacking a single joint, especially if the articulation is free from pain, although the seat of advancing deformity, for the occurrence of ataxic symptoms."

The author's views concerning scrofulous diseases have been already referred to and it now only remains to quote a few sentences. "The estimate of their gravity is often formed partly from tradition, partly from what is seen in the wards and out-patient rooms of hospitals, where every day children are admitted whose joints have undergone complete disorganization." . . . "Such cases as these, however, convey a highly exaggerated impression of the intractable nature of these affections. It must be remembered that a disease of inflammatory character is very much what it is allowed to become." . . . "In their incipient period these affections are, to a degree which some appear unable to credit, amenable to the influence of appropriate treatment." . . . "The presence of amyloid disease in its early stage is no bar to operative interference, even although the urine may contain a considerable amount of albumen." Rest, prolonged for years if necessary and—until the very last—in the horizontal posture, is the treatment advocated, there being no risk, so maintains Mr. Marsh, that the joint will be rendered stiff by the rest alone. As to this latter point we are in perfect accord with the author.

"Epiphysitis and Acute Arthritis of Infants" form the subjects for an interesting and instructive chapter. "Quiet Disease" is next treated of, wherein it is stated that instances "are not rarely seen in children between four and twelve, in whom the shoulder-joint is found to have become stiff, though none of the other signs of disease have been observed." So with other joints. These cases are apt to be confounded, in their early stages, with cases of muscular rigidity following injury, all the more so because at first under an anæsthetic the joint moves freely and smoothly. "In the hip all the usual symptoms, except stiffness, may be so entirely absent that for many months no suspicion of the real state of the case is excited."

Complete rest for months is the only treatment, and in many cases the joints will ultimately recover with good motion. In some cases, however, rapid ankylosis sets in, and these are the cases which have given rise to the idea that joints kept at rest become ankylosed, but this is the marked exception even in "Quiet Disease." Syphilitic diseases of joints, the joints in hæmophilia, diseases of bursæ, and the formation of cysts in connection with the joints, are all sufficiently fully treated of. Loose bodies in joints are elaborately discussed and operative interference with antiseptic precautions is advised, with the pertinent remark "that the statistics of fifty years ago have no bearing whatever on the practice of the present day."

Internal derangement of the knee and other joints is shown to be far more frequent than is commonly supposed. When dealing with a case where the injury which has produced the displacement is severe enough to cause also acute synovitis, or where the displacement has produced the latter complication, caution is requisite lest the luxation of the cartilage be overlooked, and the stiffness remaining after the inflammation has subsided be attributed to this cause. Where the slipping of the cartilage becomes inveterate two varieties of clamps are figured which are notably efficient, but do not interfere with walking. Reference is made to Prof. Kocher's description of what he terms meniscitis fungosa, or fungous enlargement of the internal meniscus of the knee-joint; removal by operation is all that is available in such cases. Much interesting matter is contained in the chapters on "Bone-setting," and "Congenital Dislocation of the Hip," but no comments will be made except the statement that the author seems to show conclusively that slight varieties of congenital hip luxation often exist which are either overlooked or mistaken for some other trouble.

An able chapter is devoted to the "Prejudicial Effects of Intra-articular Pressure and on the Danger of Producing it by Surgical Appliances." It will perhaps be difficult for the reviewer to make plain that which the author demonstrates so well by means of a few diagrams, but the subject is of too much importance to be passed over. The author conclusively demonstrates, that while extension by weight and pulley in a perfectly extended hip or knee will *remove* intra-articular pressure, yet if the leg be flexed upon the thigh or the thigh upon the pelvis, by the spasmodically contracted hamstring muscles in the former and the ilio-psoas muscle in the latter, these structures at once become fulcra and the articular surfaces are brought into abnormally close contact by leverage of the second order. For this reason extension should, at first, be always made in the *direction of deformity*, and gradually, in the course of a few weeks, the line of traction may be changed as the irritated muscles relax, until the knee or hip is perfectly extended. The practitioner would do well to consult this chapter, which, to our mind, seems the one most pregnant with good results.

The chapters on nervous mimicry and tumors of joints, while up to the average, demand no special notice.

In fibrous ankylosis after strumous disease emphatic warning is given against the attempt to restore movement, a most fatal error, which we think must have now fallen into almost total disuse, since it has been almost universally discountenanced of late years. Two omissions we regret to see in the advice concerning breaking of fibrous ankylosis, viz., the advisability of perfect quiet for a few days, the immediate application of an elastic bandage, or elastic pressure by compressed sponge, and the use of dry cold when the operation is a severe one, for in this way much can be done with perfect safety and much utility; and that dislocation of the head of the tibia backward may be partly or entirely prevented, when attempting to straighten a contracted knee by subcutaneous division with a tenotome of the anterior, or even both crucial ligaments, a practice—following the lead of a well-known surgeon—which we have long advocated and seen prove successful: the patella may likewise be dissected off subcutaneously when adherent. Of course, strict antiseptic precautions must be exercised.

Mr. Marsh contends that we must entirely revise our ideas as to excision for strumous disease, that the statistics of even ten years back are in many instances obsolete, that excision is now comparatively not dangerous, that strumous disease both by conservative and operative treatment has alike only about ten per cent. of mortality, allowing the widest margin; that "excision under favorable conditions can be, and had better be, avoided;" that "recovery will, as a rule, except in very advanced disease, be secured by rest;" and, finally, he believes "that in the future excision will fall more and more into disuse, as the treatment by rest gradually wins its way." While by no means a pessimist, we can hardly feel justified in indulging in such roseate visions, when we reflect upon the perversity and unwillingness to submit to restraint for lengthened periods shown by the average patient or parent.

Excision of the shoulder is said to be, "on the whole, deservedly unpopular," an opinion from which we most positively dissent. In excising the elbow, to gain a flexible joint, the rule is given that the ends of the bones should present an interval between them of at least half an inch when put up in the splints. Excisions of the other joints are viewed very unfavorably, being really advised only for the removal of deformity in the case of the knee, or for deformity plus extensive suppuration in the hip. Diseases of the different articulations are elaborately, and we think well treated of in the remainder of the book, but from what has already been said little remains for us to call the attention of our readers to, since the details differ in no material respects from those of other standard works.

We wish that experience in our own practice or in that of our friends could induce us to agree with Mr. Marsh in his favorable views as to the mortality and after-condition of cases of strumous knee and hip disease. Thus, in the knee, recovery may "be confidently anticipated except in a few cases in which the disease proves to be more than commonly destructive." For the hip, he says: "In cases that are detected early and adequately treated perfect recovery, with complete restoration of movement, may often be obtained. In many others the only appreciable defect is a slight limp, due either to loss of free movement, to reflex atrophy of the muscles, or to slightly arrested growth of the limb. Even in instances in which disease has produced faulty position and suppuration, the treatment by rest continued for a year or for a still longer period, and combined with extension to correct distortion, and with the early evacuation of pus will often enable children to recover without deformity, with almost perfect movement in the joint, and with scarcely a limp." Surely this is a most exaggerated statement of the facts.

Although we have seen fit to differ from Mr. Marsh both on theoretical and practical grounds in some few instances, yet we regard the book as excellent, and one the writing of which will redound to the credit of the author. This, like all the other clinical manuals issued by this firm, possesses one preëminent advantage, viz., that, however much the views of the authors may differ from those we, or others, hold, the opinions are enunciated by those who have been taught by extensive experience, and not by ambitious writers, who, desirous of the name author, are too often evidently first becoming acquainted with their subject when studying the literature relating to it. C. B. N.

RECENT WORKS ON THE TREATMENT OF THE INSANE.

1. THE CURABILITY OF INSANITY: A SERIES OF STUDIES. By PLINY EARLE, A.M., M.D., Late Superintendent of the State Lunatic Hospital, at Northampton, Massachusetts, etc. 8vo. pp. 232. Philadelphia: J. B. Lippincott Company, 1887.

2. THE PRIVATE TREATMENT OF THE INSANE AS SINGLE PATIENTS. By EDWARD EAST, M.R.C S., L.S.A., Member of the Medico-Psychological Association. 12mo. pp. 68. London: J. & A. Churchill, 1886.

3. INSANITY AND ALLIED NEUROSES: PRACTICAL AND CLINICAL. By GEORGE H. SAVAGE, M.D., M.R.C.P., Physician and Superintendent of Bethlem Royal Hospital, etc. 12mo. pp. viii. 544, with 19 illustrations. Philadelphia: Henry C. Lea's Son & Co., 1884.

1. DR. EARLE, one of two survivors of thirteen physicians who founded the Association of Superintendents of American Institutions for the Insane, has presented in this volume a series of "studies" on the curability of insanity. Connected as he has been as a medical officer with one asylum, as a medical superintendent of two asylums and with the literature of insanity for a period of more than forty years, whatever he may state at the close of a long and honorable service is entitled to respectful consideration. The purpose of the author is to correct erroneous impressions that might be drawn from the earlier reports of American asylums of the curability of insanity, and to ascertain the results which more extended experience has since established. In this direction the author may be said to have done an excellent work, and to have presented a successful and exhaustive arraignment and impeachment of earlier reported asylum results.

The book comprises eight so-called "studies," which have been read before the New England Psychological Society, or have appeared in the annual reports of the Northampton (Mass.) Hospital. "They have thus been an important agent in stimulating the minds of philanthropists to seek—and in several notable instances to adopt—other methods for the custody and care of a large part of the insane than that of collecting them in expensive and unwieldy curative institutions."

In 1820, Dr. Burrows, of England, reported the proportion of recoveries of all cases treated by him, 81 in 100; of recent cases, 91 in 100. In 1826–27, Dr. Todd, of the Retreat, Hartford, reported that of twenty-eight recent cases twenty-five recovered, equal to eighty-nine per cent.

Dr. Woodward, of the Worcester, Massachusetts, Asylum, says in 1837, "per cent. of recent cases discharged recovered, of less duration than one year, eighty-nine, and in his report in 1841, ninety one per cent. recovered." Dr. Galt, of Virginia, reported in 1842 an equal result, and that the West might not be outdone, or charged with doing its scientific work on a contracted scale, Dr. Awl, of Ohio, in 1843, "unpretentiously reported" his achievements of one year, as follows: "per cent. of recoveries on all recent cases discharged, one hundred." Dr. Earle in a report of the Bloomingdale Asylum for 1844, states that "when the proper remedial measures are adopted in the early stages of the disorder, no less than eighty of every hundred are cured."

Since the "summit of the maximum wave of the highest possible high-water point was gained" in the record of cures, there has been a steady decline of the per cent. of reported recoveries. Dr. Earle devotes a chapter to the "ebbing tide" to explain in part the sources of error in the early hospital reports in this and other countries, and to present some conclusions as to the curability of insanity. It is shown:

> "1. The reported recoveries from insanity are increased to an important extent by repeated recoveries from the periodic or recurrent form of the disease in the same person; and consequently,
>
> "2. The recoveries of *persons* are much less numerous than the recoveries of *patients* or *cases;* and, consequently,
>
> "3. From the number of reported recoveries of *cases* or *patients*, it is generally impossible to ascertain the number of *persons* who recovered.
>
> "4. The large proportion of recoveries formerly reported was often based on the number of patients *discharged*, instead of the number *admitted*, and *generally*, upon the results in a number of cases too small to entitle the deduction therefrom of a general formula of scientific truth; and those proportions were evidently increased by that zeal and rivalry which frequently characterize the earlier periods of a great philanthropic enterprise."

To illustrate, the data from which Dr. Earle has drawn his deductions are furnished from an analysis of the operations of the Friends' Asylum, by Dr. Worthington, and reports of other asylums. One thousand and sixty-one recent *cases* were admitted into the Friends' Asylum during a period of fifty-nine years of which sixty-five per cent. recovered, but these *cases* were not *persons* and eighty-seven of the persons recovered two hundred and seventy-five times, or one hundred and eighty-seven times more than the number of persons. At the Hartford Retreat five persons furnished fifty-four recoveries; at the Bloomingdale Asylum five persons furnished eighty-five recoveries; at the Worcester Hospital two sex groups of five each one hundred and thirty-six recoveries; and in one other hospital one person furnished thirty-four recoveries. While these are probably extreme illustrations, it appears on examination that of 11,000 cases admitted into the Worcester Hospital, the number of persons was only 8204, and a similar result might probably be shown in the statistics of other hospitals.

Turning to a later period, the author, in the concluding chapter, proposes to show the results of treatment in a large number of foreign and domestic institutions, bringing our knowledge to a recent date, and presents what may be considered the hospital work accomplished at the present day. For this purpose he uses the statistics of forty-six English and Scotch asylums from 1872 to 1882 inclusive, published by T. P. Chapman, England, in the *Journal of Mental Science* for July, 1884. The collection embraces 93,543 cases, of which 35,468, or 37.9 per cent. of the whole number of admissions, recovered.

Considered with reference to the duration of less than one year 69,983 cases are classified as follows:

First attack, less than three months,	38,283	Recoveries,	18,654	Per cent.	48.72
" " three to twelve months,	12,126	"	3,421	"	28.21
Not first attack, less than twelve months,	19,574	"	10,494	"	53.61
Totals,	69,983		32,569		43.51

The American result is ascertained by taking the recoveries reported at twenty hospitals at three periods of their existence, viz., the first five year period dating from the opening of the asylum; the second five year period begins with 1871; and the third period of five years begins with 1880.

Aggregate admissions first period,	14,516	Recoveries,	6,689	Per cent.,	46.08
" " second period,	24,383	"	8,354	"	34.26
" " third period,	23,052	"	6,896	"	29.91
Whole number,	61,951	"	21,939	"	36.71

At fifty-eight American institutions the whole number of patients admitted in one year, 1884, was 14,372, of which 27.88 per cent. recovered.

Dr. Earle has done a good work in his successful effort to point out sources of error in the statistics of insanity which appear to have had their origin in the New England States, and with his early contemporaries. For more than twenty years, however, they have been recognized and avoided by the leading hospitals of the country. While the per cent. of reported recoveries has been steadily declining, the fact might have been properly ascribed to a limited knowledge of the nature of insanity that existed at an earlier day; to preference in admission given to recent cases and exclusion of chronic cases; to the increased number of hospitals at the present day, and the distribution of the limited number of recent cases among a larger number of asylums; the retention of chronic cases in the asylums to a greater extent than ever before, and not to a decline in the means or skill in the treatment of the insane. As a matter of fact, never in the history of the care of the insane were they treated in a more enlightened and humane manner, or with more knowledge and intelligence. We may go even further and express the conviction that recent cases of the present day are more successfully treated than at any previous period. A perusal of the book may tend to a pessimistic view of the whole subject, yet such an impression was hardly intended to be conveyed by the author. We must accept his purpose to furnish an argument sustained by statistics which he believes has already "caused a very important change in the statistical methods of Massachusetts, in this country, Great Britain, and in Europe."

2. Mr. East assumes that treatment in the patient's own home will be first attempted, " but, as a rule, will fail because of the many familiar ways and habits of the home, where the patient has been accustomed to command, and to do as he pleases," and concedes that if the patient is not so ill as to be confined to one room it is generally best to intrust him to the care of a medical man in a house with trained attendants selected by him, which is to be understood as the author's plan for the private treatment of the insane.

Several reasons are furnished for preferring the private method of treating cases of unsound mind:

> "First, greater secrecy; second, the stigma of having been an inmate of an asylum is obviated; thirdly, patients recover quite as satisfactorily and more quickly if not compelled to mix with others similarly afflicted; fourthly, the exercise of a little care will, in many instances, insure the return of the patient to his home without any of his acquaintances becoming aware of the reasons that have led to his absence; fifthly, that each case receives more individual attention at the hands of the medical man and attendants employed, and there is a better chance of his getting the exact treatment suitable to his case, a practical impossibility in an institution numbering its patients by hundreds."

If for any reason the patient is not a suitable case for private treatment, the author prefers an excellent hospital for the insane to a private asylum.

Strangely enough, none of the reasons presented seem to have been founded on the results of professional experience definitely ascertained. They are rather a concession and deference to the private feelings and interests of the friends of patients which naturally exist, and to ill-founded traditional prejudice against established hospitals prevalent in the public mind. The chapters devoted to "Selection of Attendants," "Treatment," and "Tact," contain no suggestions which are not, or may not be, as well or better carried out in organized hospitals with a larger plant and resources, than any system of private treatment can afford. If, as is alleged, the insane person may awaken to reason and be shocked to find himself surrounded by the insane in a hospital, so it may be supposed he may awaken to find himself in a strange house surrounded by strangers, a close prisoner perhaps without the warrant or sanction of law. Both of these supposed awakenings may, however, be regarded as extremely hypothetical, as all experience shows that changes are usually gradual and not sudden.

The detention of insane persons, singly, in private houses is a responsibility that may be intrusted to a very limited number of persons without risk of abuse. Yet experience has shown that it is wiser and safer for all concerned that single, private care of the insane in houses, other than in their own homes, should have the sanction of law and the supervision of State officers. Of the results of private treatment of the insane the author has made no statement from which its value may be estimated. In the last report of the English Commissioners of Lunacy may be found the proportion of per cent. of recoveries to admissions for the year, which is presented in this connection:

County asylums	42.26	Registered hospitals	45.56
Metropolitan licensed houses	39.07	Provincial licensed hospitals	36.48
Private single patients	10.83		

The book has no special suggestions or advantages to offer for the benefit of the insane of the indigent or middle class, but is in the line of improved care of the insane of the private class who are able and willing to pay a large weekly charge. It is also to be accepted as a mild protest against some of the acknowledged defects of the existing hospital system which time and improved plans will correct. J. B. C.

3. The name Bedlam is so inseparably connected with, and made a part of the history of the treatment of the insane, and so much that has

redounded to the credit of England's lunacy administration received its birth and impetus in the revelation of the practices of old Bedlam, that it seems eminently fitting that from modern Bethlem a clinical text-book should be evolved, replete with ideas and suggestions for the better care and treatment of the insane. As one of the editors of the *Journal of Mental Science*, the organ of the British alienists, Dr. Savage has for a long time been known as a man of progressive ideas; but it is, perhaps, as a clinical teacher at Guy's, and in the wards of his own hospital, that his work has been most effective, if not the most widely known.

The work under consideration is the result of an attempt to "take stock" of a mass of observations and deductions accumulated during the experience of twelve years as a superintendent of a hospital for the insane, and a lecturer on insanity, and, as would be expected, is of a very practical nature.

Dr. Savage is met at the outset by the same difficulty which all writers upon mental disorders have encountered, when he attempts to define insanity. From a medical standpoint, he says it is to be considered "a disease of the brain." Would not it be more in accordance with the facts to say a symptom of a disease of the brain? To borrow from the author's own words, "sanity" and "insanity" are words which we use to designate certain conditions, neither of which can be rigidly confined within the bounds of a definition, and as we regard sanity as the condition resulting from the normal action of a healthy brain, so we must consider insanity as the symptom of a diseased brain, and not as the disease. Dr. Savage says, in discussing this point:

> "A man in fact must be considered as sane, or insane, in relation to himself. The old, and oft-repeated statement that insanity is a perversion of the *ego*, is absolutely true. Sanity and insanity, then, are to be measured by differences or changes of habit, taste, and disposition in the individual, as well as by other symptoms of change in the nervous centres. The difference will necessarily be seen to be not only one of degree, but one of time, so that a man being sane now may be insane within a longer or shorter period. I shall take it for granted that insanity depends upon change in the nervous structures of the body; but by no means shall I restrict the causation of insanity to changes in the brain alone. . . . . But the more I see of insanity the more convinced I am that the consideration of mental disorder can only be fairly approached by the complete consideration of general physiology—*i. e.*, the development, growth, and decay of the body in all its parts."

The subjects of eccentricity and genius are touched upon, incidental to the general subject of insanity. Eccentric people are divided into two classes: 1. Those having a neurotic inheritance, and who are, in fact, on the border-land of insanity, and 2. Cases developed *de novo*, who pass through life without any marked access of mental disturbance. The classification adopted by Dr. Savage shows at once that he approaches the subject from a clinical standpoint, and that he does not propose to lumber up his work or confuse his readers with the fine and unnecessary divisions and subdivisions so much affected by dilettante writers.

From our present knowledge of insanity and the pathological processes which lead up to it, it necessarily arises that any scheme of classification must be imperfect, and that various forms of mental disturbance will be found to belong—in some respects to one, in some respects to another division of the classification. In certain cases the etiological factors are so prominent that they are instinctively classified according to their causes. In some symptomatic, and in others somatic features predominate, and until the time arrives when we shall have a clear knowledge of the pathology of insanity we must despair of a perfect classification. When that time arrives, if it ever does, then even we shall be met by the difficulty resulting from the fact that similar mental states may be caused by the same apparent condition of nerve disease or degeneration.

Dr. Savage groups his cases as follows:

> "Hysteria—mania. Hypochondriasis—melancholia.
> "Dementia, general and partial, primary and secondary.
> "States of mental weakness—chronic mania and melancholia, recurrent insanity, delusional insanity, general paralysis of the insane.
> "Paralytic insanity—epileptic insanity.
> "Puerperal insanity—postconnubial, puerperal, lactation.
> "Toxic insanity—alcohol, lead, opium, chloral, etc.,—gout.
> "Visceral insanity—renal, cardiac, and pulmonary.
> "Insanity with syphilis—myxœdema—Graves's disease—asthma—diabetes.
> "Idiocy in its various degrees."

Before giving his own classification he gives that of the College of Physicians of London, which he calls the ideal classification.

The chapter on causes is an interesting inquiry into the assigned causes of insanity—predisposing and exciting, general and special.

Following the chapter upon causation, Dr. Savage takes up, in the order of his classification, the various forms of insanity and discusses them in an able manner.

The author is not only an able clinical teacher but an experienced pathologist. His experience in the wards of Bethlem and in the pathological laboratory have not led him to take a very optimistic view of our present knowledge of the pathology of insanity. He says in one of the earlier pages:

> "I may say that, with my experience of years, and after seeing many hundreds of *post-mortem* examinations of the bodies of the insane, I have met with few coarse changes within the skull, and even with the higher powers of the microscope all that can often be detected may be evidences of change in the nutrition of the connective tissue of the brain."

As regards the future, he is more hopeful; he says:

> "The time will come when the inter-relations between the millions of nerve cells with their manifold processes, and their dependence for healthy action upon healthy blood and pure air, will be better understood."

He likens the brain to the kaleidoscope, in which the pattern of the image changes while the parts remain the same, being simply changed in their relations to each other.

When will the physiologist or pathologist appear who shall teach us to recognize the characters and determine the causes of these changes of relation? And when shall we be taught how to restore the parts to their original pattern?

In view of the recent publication of Dr. Earl's work on the *Curability of Insanity*, Dr. Savage's remarks upon the subject are of interest:

> "There is, in fact, a very strong feeling prevalent that a patient once having had an attack of insanity is never cured under any circumstances. This I shall oppose entirely; but I acknowledge that a very considerable proportion are maimed in one way or another by an attack of insanity."

In the matter of treatment, Dr. Savage will be found to agree in all essential matters with the practice of the better asylums of the United States. He is in favor of asylum care for the majority of cases, as affording the best hope of recovery. Of home care, he says that it is "only suitable for cases in which there is a hope of speedy recovery, and where there are judicious friends and sufficient space." Except in special instances he deprecates what is called "single care," and is convinced that other things being equal, more patients get well when associated with others than when under single charge.

The manual is written in a pleasing style and can be read by those even of large experience with profit. It will be found to confirm by its well-digested clinical facts a doubtful opinion in the minds of some or to correct a mistaken conclusion for others. For the general practitioner, it perhaps presupposes too much an elementary knowledge of the subject, which, unfortunately, the majority does not possess, but even the general practitioner will find the work of great interest and value.

E. N. B.

La Langage Intérieur, et les diverses formes de l'Aphasie. Par Gilbert Ballet, Professeur agrégé a la Faculté de Médecine de Paris. Pp. xvi. 174. Paris: Germer Ballière et Cie, 1886.

Inner Speech and the Different Forms of Aphasia. By Gilbert Ballet, Associate Professor of the Faculty of Medicine in Paris.

On Aphasia; Being a Contribution to the Subject of the Dissolution of Speech from Cerebral Disease. By James Ross, M.D., LL.D. Pp. ii. 128. London: J. & A. Churchill, 1887.

Each of these attractive little volumes presents, in a clear and comprehensive manner, the results of recent investigations, both clinical and pathological, upon the interesting condition of disturbance of speech.

Ballet approaches the subject from the psychological side, and discusses the mental processes involved in spoken language. He shows that men differ from one another in the manner, as well as in the matter, of their thinking. Some listen to the ideas as they flow through the mind, hearing the murmur of the stream of thought (les auditifs). Others are spectators of a series of mental pictures, and are continually watching the changes that pass before the mind's eye (les visuels). Others still, can only grasp an idea by a sort of inward effort of articulation, a silent process which, in children, is often evident in the motion of the lips which accompanies early attempts at reading (les motifs). Thus, in our inward speech there are various elements, one of which predominates in every one.

This may become more evident if Charcot's analysis of the mental constituents of the idea "bell" be considered. This idea, like that of any other object, is made up of a number of mental pictures. There is the picture of the appearance of the bell—the visual memory; there is the picture of the sound of the bell as it rings—the auditory memory; there is the picture of the sound of the word "bell" when spoken—the word-hearing memory; there is the picture of the word "bell" as printed or written—the word-seeing memory; there is the picture of the muscular movements necessary to say and to write the word "bell"—the word-uttering, and the word-writing memories. These pictures together form the complex mental image involved in the idea "bell;" and the same is true of the idea of any concrete object. It will be noticed that four of these mental pictures are sensory in their origin, and that two are motor. All are necessary to the perfect representation of the idea to the mind, or for perfect expression in speech. Aphasia, according to Ballet, consists of the loss of one or more of these mental pictures, and is sensory or motor according to the character of the image lost. Loss of visual or auditory memories is rare, and may not affect speech, although it is usually associated with aphasia. Loss of the word-hearing memory is known as word-deafness, or amnesia. Loss of the word-seeing memory as word-blindness, or alexia. Loss of the word-uttering memory constitutes aphasia proper. Loss of the word-writing memory produces agraphia. These forms may be combined in any one case, but often occur alone.

It is evident that the work of Ballet is founded upon the lectures of Charcot, recently collected and issued by Bernard ("De l'Aphasie et de ses diverses formes," *Le Progrès Médical*), and that its claim to originality, either of conception or presentation, is very slight. Nevertheless, it is clearly written, and as it is issued as a volume of the Bibliothêque de philosophie contemporaire, it may be regarded as a successful semi-popular presentation of the subject.

Ross takes up the subject of aphasia from the clinical standpoint, and gives most interesting and well-studied cases illustrating the varieties of the "dissolution of speech." He divides aphasia into a motor and a sensory form, but admits that these are frequently combined. Motor aphasia presents three varieties: (1) aphemia, which presents many degrees from a slight defect in the power of expressive speech up to absolute wordlessness; (2) agraphia, which may vary from a condition in which the patient makes mistakes in spelling and diction, up to a state in which he cannot write or copy a single letter; and (3) amimia, a condition in which gesture language is suspended, and which, so far as known, is a theoretical form not yet observed. Sensory aphasia also presents three varieties: (1) the aphasia of recollection, in which the idea of an object fails to revive its corresponding word; (2) psychical blindness, in which the visual image of the object is lost, or its word-image is lost (word-blindness), or even the letters of the alphabet are no longer recognized (literal blindness); or in which there may be a partial perceptive blindness, which is not, however, to be regarded as aphasia; (3) psychical deafness, in which the acoustic imagery is impaired, the words being no longer recognized when heard (word-deafness), or at the command of the memory when needed; and this in its extreme form may be partial perceptive deafness in which ordinary sounds, such as the tapping on a door, are no longer understood. Ross distinguishes four or five different degrees of each of these forms of aphasia, a subdivision which seems somewhat artificial, and complicates the subject unduly.

Paraphasia, in which the motor and sensory forms are combined, presents several degrees from the mere substitution of a wrong word for the right one, up to the condition in which the patient talks gibberish; the intermediate forms being the condition in which the patient is compelled to substitute for the correct word a paraphrase of it, or a wholly inappropriate term, and the condition in which the patient fails to appreciate the right name when uttered in his hearing.

Paragraphia is described as the condition in which the individual is unable to write correctly, or to write a continuous sentence, or to write a single word, or to copy.

Paralexia may consist of a transposition of words in reading aloud, which may be so extreme as to result in a gibberish altogether unintelligible to the listener.

Each of these forms is shown to have as a pathological basis a definite lesion in the brain at one part or other of the cortex. Motor aphasia is caused by a lesion of the left third frontal convolution. Agraphia is produced by a lesion in the second frontal convolution. Word-deafness is due to destruction of the first and second temporal convolutions in their posterior part. Word-blindness is produced by a lesion of the inferior parietal lobule and angular gyrus. Paraphasia, paragraphia, and paralexia are ascribed to lesions involving two convolutions in distant parts at once, or to a very large lesion involving an extensive area of the cortex. The usual explanation of these latter forms, urged by German authorities, is that they are due to destruction of the nerve fibres which pass beneath the cortex and associate the various areas with one another; but Ross does not favor this view.

The latter half of the book contains a careful critical study of the various explanatory schemes which have recently been offered by writers on aphasia; those of Kussmaul, Charcot, Lichtheim, and Broadbent being shown and discussed. To any one who cares to enter upon a minute study of aphasia, and to learn the many important bearings of the subject upon the psychological problem of the relation of mind and brain, this part of the work will be of great interest and value. Ross follows Hughlings Jackson very closely in his development of the theory of the evolution and dissolution of speech. The originality of the author is not however lost, and his critical insight and wide clinical experience combine to keep the discussion within medical lines. The easy diction and attractive style make the work an entertaining addition to the literature of aphasia. M. A. S.

Department of the Interior. Bulletin of the United States Geological Survey, No. 32. Mineral Springs of the United States. 8vo. pp. 235. Washington: Government Printing Office, 1886.

Although the number and extent of the so-called mineral springs of the United States are never realized till one reads this Bulletin of the United States Geological Survey, a careful perusal of the results there obtained go to show that the number of springs possessing any real value as medicinal agents is comparatively small.

Many of the so-called hot springs have been found to possess no larger amounts of mineral matter than ordinary indifferent waters, and largely depend on their heat for any therapeutic powers which they may possess.

The chief value to the ordinary medical practitioner of a publication of this kind is to enable him to discover whether or not springs possessing powers for good exist in accessible regions in this country, and whether, if accessible, they approach the foreign waters closely enough to be substituted for them.

The space allotted to a review of this character does not permit of an extended comparison of the mineral waters of this country and abroad, and for this reason only the most important will be considered.

Roughly stated, the springs which are generally looked upon as valuable for medicinal purposes contain one or more of the following ingredients; namely, sulphur, chalybeate matters, arsenic, salines, and sulphuric acid, and perhaps lithium. Suffice it to state that in the United States we have waters possessing all these properties to a marked degree. Not only have we springs in this country which to a large extent may be used in place of European waters, but in some instances the springs of the United States actually surpass in a considerable degree those of other countries. Thus, the so-called saline springs, such as Saratoga, compare very favorably with corresponding waters on the other side, while the Balston springs of New York not only surpass all foreign springs in mineral constituents (135 grains per pint), but also excel the saline waters of Homburg, Kissingen, Wiesbaden, and Selters in their percentage of carbonic acid (53 cubic inches). Not only does this remarkable spring contain these constituents in such large amount, but it also possesses a large proportion of the carbonate of lithia—0.701 of a grain.

The springs of the United States corresponding most closely to the celebrated ones abroad are, probably, the following:

Sulphur springs: Lower Blue Lick, Nicholas Co., Ky.; Sharon, Schoharie Co., N. Y.; White Sulphur, Greenbrier Co., Va.; Salt Sulphur, Monroe Co., W. Va. Epsom salt: Bedford, Bedford Co., Pa. Sodium chloride: Hathorne, Saratoga, N. Y.; Balston, Saratoga Co., N. Y. Iron: Oak Orchard, Genesee Co., N. Y.; Rockbridge Alum, Rockbridge Co., Va.; Cooper's Wells, Hinds Co., Miss. Glauber salts: Crab Orchard, Lincoln Co., Ky.; Midland, Midland Co., Mich.

As regards the geographical distribution of mineral springs in the United States, it is found that of the Eastern States, New York and Virginia have the largest number of active medicinal waters, while the States and Territories west of the Mississippi River contain nearly all the important thermal springs we possess, with the exception of a few scattered along the Appalachian chain in Virginia and one at Lebanon, N. Y.

It is probable, too, that large numbers of the so-called medicinal springs do not possess constituents capable of acting in any way directly on the organism but rather do good by "sluicing" the renal organs and thereby aiding elimination, or, when used in baths, by increasing the action of the skin.

In conclusion, the labor involved in such a report can scarcely be estimated, and those having it in charge are to be congratulated on presenting the public with so interesting and valuable a compilation. The benefits of such publications have already been partially pointed out, and are too obvious to need further comment. The only fault that can be found with it is in the index, which, while good and copious, gives only the name of each spring without stating its chief constituent, and, as a consequence, one is forced to look up many references before he is able to find any number of a given variety of waters for comparison. Under the act of Congress, this Bulletin can be obtained by enclosing a money order for 20 cents to the Director of the United States Geological Survey, Washington, D. C. H. A. H.

TRANSACTIONS OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY. TWENTY-SECOND ANNUAL MEETING, 1886. 8vo. pp. 220. Boston, published by the Society.

THIS second part of the fourth volume is the largest annual contribution which the Society has yet made to its transactions, and the matter it contains makes it by far the most important American contribution of the year to the literature of ophthalmology; many of the papers, too, are of general interest.

The retinal lesions connected with albuminuria are extensively discussed: Dr. C. S. Bull contributing an "Analysis of One Hundred and Three Cases of Exudative Neuro-retinitis Associated with Bright's Disease;" Dr. George C. Harlan, a case of "Thrombosis and Perivasculitis of the Retinal Vessels;" and Dr. S. D. Risley a case of "Albuminuria of Pregnancy; Retinitis; Induced Premature Delivery."

Bull excluded all cases due to scarlatina or pregnancy, and reported only such as he had been able to follow to their termination, or to the date of the report. His patients included fifty-six men and forty-seven women. Both eyes were affected in ninety-three cases; hemorrhages occurred in one or both eyes of sixty-nine patients; while all but three came to present evidence of cardiac hypertrophy with or without valvular disease. In thirty-two cases vision improved under treatment, but without absorption of the glistening exudation at the macula.

In this series of cases the gravity of the prognosis is well illustrated. Thirty had died within six months after they were first seen, and in the next six months twenty-seven more. In the second year eighteen died; in the third year, six; in the fourth year, four; and in the sixth year, one. Of the seventeen still living, fourteen had been first seen within the last six months; two others within a year; and only one had been first seen seven years ago. In the discussion Dr. Gruening stated that of one hundred cases he had collated, none had lived more than two years.

For those cases arising from scarlatina, and especially in those from pregnancy, the prognosis is entirely different. This is well illustrated in Dr. Risley's case, where the patient, after being almost blind, with the urine loaded with albumen, and after premature delivery becoming unconscious and hemiplegic, and subsequently exhibiting aphasia, made an excellent recovery, vision coming up in the right eye from counting fingers at two feet to $\frac{20}{\text{XXX}}$, and in the left from $\frac{10}{\text{CC}}$ to $\frac{20}{\text{XX}}$; while the very extensive retinal exudation disappeared entirely from the latter, and left but a few splotches on the eye-ground of the former.

Dr. Harlan describes a case of almost universal change in the retinal vessels of one eye, with small hemorrhages and other slight retinal changes in the other eye, in a patient who shortly afterward had albuminuria and partial left hemiplegia. The case is illustrated by a plate showing the appearance of the fundus; the darker red of the normal vessels being replaced by broader bands of glistening white.

It has from time to time been remarked that "Listerism" and the "gospel of cleanliness" seem to arouse no general interest among ophthalmic surgeons. The reason doubtless is, that it has never been customary to invite assistants to thrust their dirty hands into the corneal incision; while the dictum of high authority forbade the introduction of any instrument not absolutely necessary, and the necessity for perfectly keen edges, and smooth-working joints invites to scrupulous cleanliness of such instruments as must be introduced. Then, too, the constant bathing of the eye by the lachrymal secretion, and the outpouring of the aqueous humor through any corneal incision tended to prevent infection. So that the ophthalmic surgeon practised asepsis, as the rustic talked prose, without knowing it. But although this was generally true, it occasionally happened that in the most promising case, after the neatest operation, an eye would be lost by general purulent inflammation; indicating, that to be right by chance, is not so safe as to be right by definite knowledge. Attention is called to the subject by Dr. H. Knapp, by some "Remarks on Pyogenic Microörganisms, with Demonstrations and Experiments." The demonstrations included the making of cataract extractions upon the eyes of four rabbits; on the left eyes with clean instruments, on the right with instruments contaminated with staphylococci. The operations were rudely done, and the injury to the left eyes increased by stirring the deeper parts with a sterilized hook. Yet while the right eyes all showed free suppuration when exhibited twenty-four hours later, three of the left eyes remained free from suppuration throughout, and the fourth, showing it at a later date, was believed to have been contaminated by the right eye of another rabbit kept in the same box, so that their heads were in close contact. Dr. Knapp believes that for eye surgery smooth-cutting instruments are best sterilized by washing in clean water, and wiping and polishing on a clean towel; because any efficient antiseptic solution is likely to dull a cutting edge. Tarnished instruments cannot be cleaned in this way, and rough instruments must be placed in some antiseptic solution.

Cataract extraction has its usual share of papers and discussion. Dr. G. Strawbridge offers a "Report of Two Hundred and Sixty-one Cases;" Dr. H. Knapp, a paper on "Cataract Extraction without Iridectomy;" Dr. D. Webster, "Report of Fifty Cases of Cataract Extraction with Remarks;" Dr. H. D. Noyes, "Extraction of Hard Cataract—Death on the Fifth Day—Examination of the Eye." The principal interest in these papers and the extended "discussion" which follows them, attaches to the operation of extraction without iridectomy, as to which there is an agreement that its value and the classes of cases to which it is suited are not yet fully determined; to the washing out of the conjunctival sac and the anterior chamber with antiseptic solutions, which is recommended; and to the use of cocaine for operations threatening the integrity of the cornea.

Bearing on the latter point several speakers report bad effects from the free use of strong solutions. But there seems to be a general agreement that smaller quantities, as a drop or two of a two or four per cent. solution, answer the purposes of a local anæsthetic about as well and are free from danger. It is to be feared that the danger which cocaine brings to the non-vascular cornea, both by the anæsthesia which allows the unrecognized presence of irritants, and the lessening of its nutritive supply by contraction of the neighboring vessels, is not yet sufficiently understood by many who prescribe it. Recently the writer has seen tedious and very painful inflammation of the cornea with extensive superficial sloughing and consequent opacity, caused by frequently repeated applications of a four per cent. solution of cocaine to relieve the pain of an acute catarrhal conjunctivitis. The attending physician had ordered the solution to be used at considerable intervals, the patient found it gave relief, which was of short duration, and repeated the application with each recurrence of the pain. There resulted the loss of most of the surface of the cornea, leaving an exquisitely painful ulcer and permanent damage to the sight.

Returning to our subject, we find a paper by Dr. B. E. Fryer on "The Use of Hot Water in Some of the Conjunctival and Corneal Inflammations." Not warm, but hot water is to be used. He says:

> "I was astonished in the earlier cases (it being new experience to me) at the tolerance and even indifference to the heat by the patient. Water in which I could not retain my hand a minute, apparently made no unpleasant impression on individuals who had used it at the same temperature for a few hours or for a day or two. The temperature of the water should not be lower than 140°, and as much higher as can be tolerated; of course, short of blistering."

Its use was recommended in purulent and catarrhal conjunctivitis, phlyctenular ophthalmia, and in corneal inflammations and ulcers. It is especially effective in relieving the pain of the latter. Dr. Fryer's estimate of such treatment is confirmed by other members.

Dr. Wm. F. Norris offers "Some Remarks on Asthenopia and the Changes in Refraction in Adolescent and Adult Eyes," including the report of a series of cases of hypermetropia diminishing or passing over into myopia. He regards diminishing hypermetropia and increasing myopia as different stages of the same process; and "would urge, therefore, the careful correction of every case of ametropia where there is accompanying asthenopia." "All such cases should be carefully measured under a strong mydriatic, as it is impossible to correct them accurately without it." While under the influence of the mydriatic the eye should be protected by dark glasses, lest the excess of light "cause a low grade of chorio-retinitis, which it is much easier to call into existence than to cure."

Dr. J. A. Andrews contributes a paper on "The Electric Light as an Illuminator—The Effect of Strong Light on the Eye;" based in part on the examination and observation of eleven hundred persons habitually working by the light of the incandescent lamp of Edison. From his conclusions, we quote:

> "The *arc light* in its present state should be positively rejected as unsuitable and actually harmful to the human eye, particularly on account of its steadiness. The *incandescent light of Edison,* because of its steadiness, adequate power, and composition, is safe, and occupies at present the first position as a means of artificial illumination."

Dr. W. F. Mittendorf gives an account of "Two Epidemics of Molluscum Contagiosum," a skin disease, interesting the ophthalmologist by its predilection for the eyelids. These epidemics, including nearly one hundred cases, throw some light on the mooted question of the contagiousness of this affection.

Reports of cases; and descriptions of new instruments, tests, and procedures; with a couple of papers on geometrical optics, occupy the remainder of the volume. E. J.

L'AMPUTATION DU MEMBRE SUPÈRIEUR DANS LA CONTIGUITÉ DU TRONC. (AMPUTATION INTERSCAPULO-THORACIQUE.) Par PAUL BERGER, Chirurgien de l'Hôpital Tenon, Professeur Agrégé a la Faculté de Médecine, Membre de la Société de Chirurgie. G. Masson : Paris, 1887.

INTERSCAPULO-THORACIC AMPUTATION OF THE UPPER EXTREMITY. By PROF. PAUL BERGER. Paris, 1877.

THIS monograph by Prof. Berger is a treatise upon amputation of the upper extremity and scapula, either at one operation, or in consecutive periods. He designates this procedure as "Interscapulo-thoracic amputation," but it is usually spoken of as amputation above the shoulder-joint. The book, which is written in the French language, contains 371 pages, and is illustrated with several woodcuts and two colored lithographic plates. The style is simple, and can be readily understood even by one whose knowledge of French is not great.

The author states that the meagre notice of this operation which is found in the classical treatises upon operative surgery, renders it desirable that a thorough study of this subject should be undertaken, since the operation, though not often required, does in some, otherwise desperate, cases afford an effective resource. The histories of fifty-one cases culled from literature or from the personal experience of the author are recorded, and form the basis of the excellent critical remarks which follow. The operation is altogether modern, the earliest case recorded being that performed by Ralph Cumming, a surgeon in the English Navy, in 1808, though Cheselden figured a cured case of accidental ablation of the upper extremity and scapula in his *Anatomy of the Human Body*, published in 1768.

After giving the details of the different operations which have been performed, the author considers the subject from various standpoints, such as the mortality inherent to the operation, the causes of death, the accidents occurring during and after the operation, the indications for the operation, and the remote consequences which may follow it, and finally general considerations upon operative technique. The mortality varies with the nature of the affection for which the operation is performed, thus, in those cases where amputation is performed for pathological causes the mortality is about 20 per cent., whilst in traumatic cases 30¾ per cent. die. The mortality of primary operations, in which the arm and scapula are removed at the same time, is about the same as in secondary operations where the shoulder blade is removed some time subsequent to the primary operation. This is rather an exceptional fact, as it is a common observation that a primary amputation at a certain height is usually more fatal than a secondary operation performed at the same level. Amongst the immediate results which may occur are hemorrhage, the entrance of air into the veins, shock, and purulent infection. Air has found entrance into the axillary vein upon four occasions, as was announced by a peculiar gurgling sound and followed almost immediately by alarming sycope. All these patients recovered from this accident with one exception.

This operation has been performed for tumors of the humerus and scapula, usually malignant in character, for osteitis, and gunshot wounds. Of the fifty-one cases reported eleven were done by American surgeons; the first complete ablation of the upper extremity, scapula, and greater part of clavicle at one operation, was performed by Dr. Dixi Crosby of the United States, in 1836. In conclusion, this thesis contains about all that is known upon this subject, and a careful perusal of its pages will be both interesting and instructive. R. W.

BEFORE TRIAL. WHAT SHOULD BE DONE BY CLIENT, SOLICITOR, AND COUNSEL. By RICHARD HARRIS, Barrister at Law. TOGETHER WITH A TREATISE ON THE DEFENCE OF INSANITY. London: Waterlow Bros. & Layton, 1886.

THIS small volume of less than three hundred pages, is neither more nor less than it professes to be. This in itself is a virtue. It is written in a pleasantly clear and concise style. It is intended for lawyers, and, as a whole, therefore, need not be fully considered here; but, as the latter part is quite as much for the doctor as for the lawyer, we refer to it. In Chapter XVII. we have the introduction to the defence of Insanity, and in the following 60 pages the test questions, the value of the decision in the McNaghton case, and the evidence of insanity and medical authority are discussed.

The note of the introduction is very unlike that sounded by most barristers, and our profession must welcome a man who is not tied and trammelled by authority. He maintains that it is justice that is wanted, the true relationship of the established facts and not the opinions of the long dead and forgotten. He says, "I have always felt that the medical profession is too little regarded in this question of insanity. Medical men are the very best, nay, they are almost the only persons capable of pronouncing a trustworthy opinion on the subject. They are too often ignored, as if they always came to get a prisoner acquitted, and as if they had a motive in so doing." We agree with this, but like our authority, we must object to authority, for it is only resting on authority, to suppose that any medical man can on general principles decide on insanity: only those can speak with any degree of force who have lived with or had many opportunities of studying nervous disorders in the insane.

In Part I. our author instructs the solicitor in his preparation of the brief when the plea of insanity is raised, and, in passing, one may say, all the evidence really is taken as if a crime is the only point ever to be considered in relationship to insanity. If our author would treat the question of validity of wills and devising capacity as well as he has the evidence in criminal trials, he would be a public benefactor.

In giving directions for taking evidence on insanity, Mr. Harris shows practical knowledge and clear insight. He reflects the popular opinion that the plea of insanity must be a last resource. As evidence of the uncertainty of the relationship of symptoms, he points out that conditions or states of unconsciousness, whether due to somnambulism, to epilepsy, or drink, may render a man ignorant of his act, and yet, while for the one a man may be considered responsible, for the other he is not.

Drunkenness is no excuse, but insanity produced by drink is; this certainly is an anomaly, for the single lapse may land a man on the gallows, while habitual intemperance may send him to an asylum.

Our author gives examples showing that one cannot decide as to responsibility by proving whether a man's mind went with the act or not, and proceeds to emphasize his belief that the defence must depend on common sense and not on technicalities; no definition of madness can possibly be made, and, therefore, it is best not to attempt to do more than lay facts, not definitions, before the jury.

No reliance is to be placed on whether a man knew or did not know that the act he was perpetrating was wrong, and the misconception of the whole question by judges is attributable, first, to universal incapacity to define insanity, and, secondly, to total misconception by the judges of what insanity is. The tendency of judges to "follow my leader," and to continue in doing unreasonable things because their predecessors did them, is forcibly exposed.

Very properly he points out the utter folly of supposing that any one test can be applied to all cases, and he shows that the fact that a policeman near at hand having a restraining influence is not conclusive evidence of criminal rather than insane intention.

"Madness has never been incompatible with knowledge except in legal minds," sums up the judgment of most lawyers on mental disorder. The test of "self restraint" being proved to be a false one, the test of knowledge of "right and wrong" is discussed and discarded as being only "the policeman at the elbow again."

"It is enough to say in answer to all such unscientific tests that insane people, like others, are subject to fear; that they refrain from committing certain deeds because they know they are wrong and that they will be punished if they commit them; and they sometimes refrain because they are under the delusion that a policeman or keeper is watching them."

Mr. Harris sees clearly that the only thing to be really decided is, whether the prisoner is sane or insane, and if he be decided to be insane nothing more should be needed. Doctors alone should decide or produce facts proving this, and they should be able to consider the facts of the man's life and inheritance, and not merely the conditions associated with the criminal act, though the crime itself is often the most marked evidence of insanity.

With all the support given to the medical witness, his weaknesses are also pointed out. "The moment medical men take sides they are useless" is a perfectly true statement of what, we regret to say, is a common occurrence.

In Part II. we have a very full discussion of the points in the McNaghton case, and as these are more for lawyers than for doctors we pass them over, only saying the whole is very trenchantly and logically considered, and all in favor of experience and common sense.

Part III. is eminently practical, showing the kind of evidence which should be produced and giving its relative value. He advises that in the brief, facts of eccentricity or injury should take the place of theory. Sunstroke in India is treated as sceptically by juries and judges as it is by asylum physicians and had better not be trusted to.

It is only for us to say that our author has a very thorough grasp of the relative value of medical indications, laying much stress on such conditions as epilepsy and neurotic inheritance. He does not quite make clear, however, that there may be brain disease without mental disorder, and we feel it would be unwise to loosen his faith in the fixed and determined connection between mind and matter lest he should become half-hearted in the future in the defence of our professional knowledge. And now we must leave this book with a very sincere hope that it will be widely read by both lawyers and doctors.

We are inclined to think in one way that it is too long and in another it is defective, and our desire would be that the more useful and practical parts should be retained in any future edition, but that the discussion on the McNaghton case and the judges' opinions should be enlarged upon and printed apart, and that other points, such as disposing and contracting capacity, should be treated.

The author would thus give us a good handbook of great medico-legal value.

THE HYGIENE OF THE VOCAL ORGANS. A PRACTICAL HANDBOOK FOR SINGERS AND SPEAKERS. By MORELL MACKENZIE, M.D. Lond. Third edition. 12mo. pp. 230, illustrated. London: Macmillan & Co., and New York, 1887.

As, according to the preface, every singer or actor of note in Great Britain, with hardly an exception, has at one time or another come under the author's hands, it was to be expected that his Handbook would have a large circulation; and so a third edition has been issued within a few months of the issue of the first.

Being intended for the general public, little note is requisite in this journal. While information and advice are given to singers and speakers with considerable detail, exception is taken as to the necessity for their knowing anything about the anatomy and physiology of their vocal and articulating organs. Amid occasional exhibitions of good, dry humor, we notice with surprise some undignified pseudocaustic raillery —*i. e.*, against teachers and others who have endeavored to go over the same and similar ground, and with whose views and results there is some discordance in the context. Pictures 12 and 13, of the appearances of the glottis in the head and falsetto registers, with an elliptic opening in the middle third of the glottis, must surely be exceptional.

Like all the advice given by Dr. Mackenzie to his colleagues, the advice given to his patients and their class is in this book good and commendable; and to English-speaking physicians treating singers and speakers, it will be of almost equal value. J. S. C.

Diseases of the Ear, and their Treatment. By Arthur Hartmann, M.D. (Berlin); translated from the third German edition by James Erskine, M.B. 8vo. pp. xiv. 283. Edinburgh: Young J. Pentland. New York: G. P. Putnam's Sons, 1887.

In the translator's preface we find that "this translation has been undertaken with the view of placing in the hands of English practitioners and students a book specially suited to their requirements." If it had been said that the task was undertaken in order to place before English readers one of the best German works on otology, we should not have demurred. We must, however, enter our protest against the suggestion contained in the above sentence, that there are not many excellent works written by English and American authors in their mother tongue. The names of many such will at once present themselves to the reader if he is interested in aural surgery.

Dr. Hartmann's work is, however, excellent, and as a book of reference most valuable. At the same time, we venture to doubt whether it is sufficiently elementary for the student or young practitioner who has not had the advantage of clinical instruction in otology.

We are glad to see that in discussing "otitis externa diffusa," the view is expressed that this affection is commonly either secondary to inflammation of the middle ear, or due to irritants—chemical, thermal, or mechanical.

With reference to exostoses of the meatus it seems to us that the author contradicts himself in the following sentences, which have been verified by consulting the German work: "This [*i. e.*, treatment] is limited to removal of obstructing matter so long as the contraction is not very great, and the dulness of hearing is only caused by temporary obstruction of the space which exists." . . . "As a rule, the exostosis should be removed as early as possible, especially if still growing, as the operation is more easily performed the less the meatus is occluded."

The advice given on page 145 is perhaps not quite in accordance with the views of English and American aurists, many of whom regard the use of bougies for the Eustachian tube with suspicion if not distrust.

In the section on "Chronic Inflammation of the Middle Ear without Exudation," we find the various methods of treatment discussed; we would, however, take exception to the statement that "vapor of chloride of ammonium, which has been in use for a long time, is now rarely employed." We think that one of the forms of chloride of ammonium inhalers now in common use, is likely in such cases—provided always the case is or has been of catarrhal origin—to be of great service after thorough patency of the Eustachian tubes has been secured. At the conclusion of the same chapter the author says: "If no benefit can be obtained by the above modes of treatment, operations must be resorted to." This is dangerous advice, doubly dangerous when it appears in a work written for students. The operations, afterward referred to, are some of them perilous, and most of them commonly useless—*e. g.*, paracentesis by the galvanic cautery, tenotomy of the tensor tympani, and excision of the membrana tympani and ossicles. We believe that this last-named proceeding may have a future before it, but we maintain that the time has not come when it can safely be recommended in an elementary work; neither do we yet know how to diagnosticate cases with sufficient accuracy to enable us conscientiously to recommend it.

Notwithstanding these few strictures we have felt obliged to make, we say again, as we said before, that Hartmann's work is, on the whole, most excellent and trustworthy.

The English edition reflects great credit on the publisher, paper, illustrations, and type being all equally praiseworthy. We are sorry to say that the translator might have done his work better. In not a few places the sense is not the same in the English as in the German work. Thus, on page 114 (English edition) the following sentence occurs: "Usually in cases of perforation [*i. e.*, of the membrana tympani, Rev.], with a knitting-needle, the consequent pain, tinnitus, dulness of hearing, and perhaps fainting occur only at intervals." The error here lies in the fact that in translating the words "nur vorübergehend," the writer has used as their English equivalent "only at intervals," whereas the sentence should run "only transient . . . occur." We have no doubt that if a second English edition should be required the translator will correct this and other similar mistakes (of which we regret to say there are not a few). We would also suggest that more attention should be paid to English composition. The following may be a literal translation, but it retains too much of the German idiom (not unmixed with a Scottish element) to be altogether acceptable to the taste of an English reader: "Therefore ought we always to open the antrum freely along with the neighboring cells" (p. 190).

HANDBUCH DER ALLGEMEINEN UND SPECIELLEN ARZNEIVERORDNUNGSLEHRE. Auf Grundlage der neuesten Pharmacopœen. Bearbeitet von DR. C. A. EWALD. Elfte neue umgearbeitete und vermehrte Auflage. Berlin: Verlag von A. Hirschwald, 1887.

HANDBOOK OF GENERAL AND SPECIAL THERAPEUTICS. By DR. C. A. EWALD.

THE object of Professor Ewald in writing his now well-known work was for the purpose of providing his medical brethren with a book on formulary, rather than a text-book, on the use of drugs in disease. Every page teems with prescriptions, and the text, while showing a widespread knowledge of therapeutical literature, is cramped and dwarfed in the endeavor to introduce a multitude of formulæ.

The pharmacological literature of every civilized nation has been drawn upon, so that nearly every prescription has appended to it the name of its originator, while the consideration of the uses and actions of the drugs has been taken from the pharmacopœias of all nations possessing an official work on medicaments. The very fact that this book has reached an eleventh edition shows us, however, that empiricism is as rife in Germany as at home, and that a very large class of practitioners of medicine still treat their patients by the shotgun method rather than by stern reasoning and logic.

As a work on formulary Ewald's book certainly distances all competitors, and although the labor involved in its construction must have been enormous, the author certainly cannot complain that his efforts have not been appreciated. H. A. H.

HIP DISEASE IN CHILDHOOD, WITH SPECIAL REFERENCE TO ITS TREATMENT BY EXCISION. By G. A. WRIGHT, B.A., M.B. Oxon., F.R.C.S. Eng., Assistant Surgeon to the Manchester Royal Infirmary; Lecturer in Clinical Surgery in the Owens College, etc. 8vo. pp. 239. With 48 original woodcuts. London: Longmans, Green & Co., 1887.

IN noticing this monograph, dealing with so many questions which, despite all experience and research, are still moot points, it will be impossible to do more than touch upon a few salient ones.

As the author has performed, between October 30, 1880, and July 8, 1886, one hundred excisions of the hip, we are warranted in concluding that he trusts but little to nature in morbus coxæ. A very fair *résumé* is given of the pathological views of all the more prominent writers who treat of hip disease, and the conclusion is arrived at "that all cases of true chronic hip disease are truly tuberculous." The chapter on "Symptoms" is full, but we can only note that swelling of the inguinal glands indicates osteitis of the pelvis rather than the femur; that "nearly every case of chronic disease of the hip," if examined "at a certain period of its course," will "be found to contain pus;" and that the disappearance of abscesses is sometimes to be accounted for by their discharge through the rectum, which "is commoner than is supposed." The belief is expressed "that chronic hip disease begins invariably, or nearly so, as an ostitis," and that "cases of true hip disease rarely recover without entire destruction of the upper epiphysis of the femur, usually accompanied by abscess, and always result in shortening, with more or less deformity, and a very large majority die; very few reach adult life." . . . When the following sentences are read it will be seen exactly what the author's views as to treatment really are: "I agree that abscesses should be opened, but as there then remains what is practically a sequestrum as the source of the abscess, I think it should be removed—*i. e.*, the upper end of the bone excised (except in cases of residual abscess. . . .);" in other words, he advises treatment by rest and extension, but if an absess forms despite this, excise in all cases. Again, "treatment short of excision when once suppuration occurs, is useful only as a palliative, or a means of temporizing." In justice to the author we must say that although he has excised in about one case out of every *six seen*, he believes that such radical treatment will not be so often required in other than hospital patients. As to the method of operating, he prefers to saw off the bone in situ through the trochanter, and then disarticulate the fragment. The elastic bandage is thought useful in the after-treatment where there is much thickening of the soft parts, or the sinuses remain "flabby and sluggish." The mortality of Mr. Wright's excisions, he contends, amounts to only three per cent., explaining two other deaths by a preëxistent pyæmia. Amputation, either before or after excision, is shown to be more applicable than is usually taught, and the implied advice is given that even with extensive pelvic disease nearly one-half of the pelvis may and should be removed after a preliminary ligature of the common iliac artery. In the appendix are given the history of a number of cases of special interest, and a very full bibliography of the subject.

Our space forbids anything like an analysis of Mr. Wright's work, which certainly advocates the most heroic treatment of this lamentably frequent disease. Those who desire to study hip disease, from an almost purely operative point of view, should read this book, but for ourselves we can only say that, being not quite so much of a pessimist as Mr. Wright evidently is, we have more faith in conservative treatment than he has, and would warn those who read his book that the views held are so extreme as to demand more proof than he has adduced in support of his position. C. B. N.

Analysis of the Urine, with Special Reference to the Diseases of the Genito-Urinary Organs. By R. B. Hofmann, Professor in the University of Gratz, and R. Ultzmann, Docent in the University of Vienna. Translated by T. Barton Brune, A.M., M.D., etc., and H. Holbrook Curtis, Ph.B., M.D., etc. Second edition, revised and enlarged. 8vo. pp. 310, with notes. New York: D. Appleton & Co., 1886.

In the Journal for January, 1880, we noticed the appearance of the first edition of the translation of Hofmann and Ultzmann's admirable work on the examination of the urine, and expressed an opinion of the worth of the original, which we still entertain. The present edition embodies the advances which have been made in the technique of examination of the urine since the first edition was prepared, and no small part of this work has been contributed by the translators. An example of the share they have taken in bringing the work up to date is found in the chapter on albumin, which, we regret to see, they still call "albumen." In doing this, they translate the German "*Eiweiss*" literally; but it is of some importance to note that the albumin found in urine is not albumen (egg-albumen).

The translators, also, use the word "cylinders" for what are universally known in English and American books as "tube-casts." This we consider an error of judgment.

We might multiply examples of too literal translation from the German in this work; but we are happy to say that the present edition is so much an improvement upon its predecessor that we cannot repeat our former comment upon the familiarity of the translators with the language in which it was first written. On the contrary, it gives us pleasure to note that many of the lapses contained in the first edition have been corrected in this one, and to commend the smoothness which marks it in general. As to the intrinsic merits of the book, we need say little. But we can say that it is one of the best and clearest works on the examination of the urine with which we are acquainted. In the part devoted to the clinical application of its teachings it is exceptionally good. C. W. D.

DIE URSÄCHLICHEN MOMENTEN DER AUGENMUSKELLÄHMUNGEN: DIE NICHT-NUCLEAR LÄHMUNGEN. Von L. MAUTHNER, K. K. Universitäts Prof. in Wien. Wiesbaden, 1886.

THE CAUSAL CONDITIONS OF MUSCULAR PARALYSIS OF THE EYE: NON-NUCLEAR PARALYSIS. By PROF. L. MAUTHNER.

IN the number of this journal for October, 1885, we noticed the twelfth instalment of Prof. Mauthner's clinical exposition of eye affections, which was devoted entirely to the nuclear paralyses of the ocular muscles. This, the thirteenth number, is a continuation and conclusion of his study of the causes of ocular paralyses, and is given to the cortical and fascicular, the basal, the orbital, and peripheral paralyses. Together, the two constitute by far the most thorough and elaborately wrought-out study of the etiology of eye paralyses that has ever been published; and implying, as the major part of these paralyses do, lesions within the cranial cavity and a direct or remote manifestation on the part of the other divisions of the nervous system, they are of more interest and importance to the physician than ophthalmological studies usually are. We therefore direct the attention of students of the nervous system to those brochures, and predict for him who is fortunate enough to peruse them, a great pleasure in following out the keen and close analysis of symptoms which is so characteristic of the writings of Prof. Mauthner.

Space is lacking for more than a simple citation of one or two salient points. In speaking of paralysis of the third pair, for example, if the branches to the iris and ciliary muscles remain free while there is at the same time contra-lateral hemiplegia, the diagnosis is fascicular paralysis; if, however, there is total paralysis of the third pair, it argues a circumscribed alteration at the peduncles at the exit of the oculomotorius, or a change extending from the pedunculus to the third ventricle, or the pathological change may be only basal.

Relapsing oculo-motor paralysis is considered in great detail, and an analysis of all the published cases given. The conclusion from a study of these cases is, that it is basal in its character, and due to a slowly developing pachy- or lepto-meningitis. He also points out as a matter of the highest practical interest, that double-sided ophthalmoplegias of an intracranial nature can be developed acutely or subacutely, and can disappear in a relatively short time.

Homonymous hemianopia, with unilateral nerve paralysis, can come from nuclear or basal changes. Amaurosis of the corresponding eye alone, or in conjunction with temporal hemianopia of the second eye, agues a basal change certainly. The orbital and peripheral paralyses are dealt with in the same exhaustive manner, but being of more especial interest to the ophthalmologist, we shall not dwell upon that part, simply commending them for the force and clearness with which the various points are put.

S. M. B.

QUARTERLY SUMMARY

OF THE

PROGRESS OF MEDICAL SCIENCE.

ANATOMY.

UNDER THE CHARGE OF

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The Constitution of the Restiform Body.

W. Bechterew has studied the development of the restiform body in a series of fifteen brains, from various periods of fœtal life. He finds that this body is made up of five constituents, which are enumerated in the order of acquiring their medullary sheath: 1. The direct cerebellar tract of the cord. 2. Fibres springing from the nucleus of the funiculus cunextus of the same side. 3. Fibres springing from the lateral nucleus of the same side. 4. Fibres issuing from the nuclei of the funiculi graciles of both sides; the set derived from the nucleus of the same side ascend to the restiform body as the posterior superficial arcuate fibres; while those springing from the opposite nucleus pass forward in the interolivary layer (olivenzuischenschichl), and emerge on the inner side of and through the pyramid, as well as between the pyramid and the olive, and form the anterior superficial arcuate fibres. 5. Fibres from the lower olive of the opposite side.

The last set of fibres were demonstrated by Meynert; but they do not, as assumed by Meynert and Wernicke, form a continuation of the posterior columns to the cerebellum. They compose, with a tract of fibres previously shown by Bechterew, ascending in the tegmentum, a system which unites the cerebellum with the base of the cerebrum through the lower olive.

Neither the formatio reticularis nor the pyramid of the medulla oblongata has any relation to the restiform body; nor does the latter receive any fibres from the fifth and eighth nerves, as stated by Edinger. The auditory nerve is connected to the cerebellum by a special bundle which ascends in the inner part of the middle peduncle. The fifth nerve has no connection at all with the cerebellum.

Within the cerebellum, the restiform body is distributed in three distinct bundles, viz.: 1. Containing the fibres from the direct cerebellar tract of the cord, from the nucleus of the funiculus cunextus, and from the lateral nucleus passes to the cortex of the forepart of the upper worm; 2. Composed of the fibres from the nuclei of the funiculi graciles, to the middle portion of the upper worm on the same side; and 3. Comprising the fibres from the opposite olive, to the gray substance of the corpus dentatum, and in part, perhaps, to the cortex of the hemisphere.—*Archiv für Anatomie*, February, 1887.

THE MORPHOLOGY OF THE SACRAL PLEXUS.

It is by no means an unfrequent occurrence for the two popliteal nerves to arise separately from the sacral plexus; and in that case the external (or peroneal) nerve generally pierces the pyriformis muscle, the lower portion of which, therefore, separates this from the more deeply placed internal nerve. But when, in the usual arrangement, these nerves are united for a certain portion of their extent in a great sciatic trunk, the latter can be easily divided into its two constituents by dissecting off the fibrous sheath, and the popliteal nerves can be followed upward to their distinct origins. By thus separating the nerves, A. M. PATERSON is enabled to show that the construction of the sacral plexus agrees in principle with that of the brachial, and to throw light upon the morphology of the nerves of the limbs.

The nerves proceeding to the popliteal trunks are each divided into an anterior and a posterior branch. By the union of the posterior branches of the descending offset from the fourth lumbar, of the fifth lumbar, and of the first and second sacral nerves, the external popliteal is formed; and the anterior branches of the same nerves, together with an offset from the third sacral, constitute the roots of the internal popliteal. The gluteal nerves are offsets of the posterior divisions, or external popliteal roots, the superior arising from the fourth and fifth lumbar and the first sacral nerves, and the inferior from the first and second sacral nerves. The small sciatic arises from the back of the second and third, and the pudic from the second, third, and fourth sacral nerves. The branch to the obturator internus springs from the second and third sacral nerves, that to the quadratus from the beginning of the internal popliteal nerve, and the nerve of the pyriformis from the posterior branch of the second sacral. The branches to the hamstring muscles are given off from the internal popliteal nerve.

Like the popliteal nerves, the obturator is formed by anterior branches, and the anterior crural by posterior branches of the second, third, and fourth lumbar nerves.

There are thus two chief sets of nerves passing to the lower limb—one comprising the anterior crural, external popliteal and gluteal, springing from posterior branches, and distributed in the original extensor aspect; and the other, consisting of the obturator and internal popliteal, springing from anterior branches, and passing to the flexor aspect of the limb. From this it is inferred that in the primitive condition of the limbs the nerves passing into them are divided into dorsal and ventral branches, which supply the corresponding surfaces, and that indications of this arrangement are retained in the mode of origin of the nerves and their distribution to the structures of the limb.—*Journal of Anatomy*, April, 1887.

ON THE BURSA PHARYNGEA.

The name bursa pharyngea was given by F. J. C. MAYER to a small pouch of the mucous membrane described by him, and afterward more fully by

Luschka, as projecting from the upper end of the posterior wall of the pharynx. According to Luschka, this pouch may attain a length of 15 mm. and a breadth of 6 mm.; it lies behind the adenoid tissue, constituting the pharyngeal tonsil; and its blind upper extremity is connected with the basilar process of the occipital bone. The normal existence of such a pouch has been denied by Ganghofner and Trautmann, who found only a small depression of the mucous membrane at the spot indicated; and for this, Ganghofner proposed the name of *recessus pharyngeus medius.* On the other hand, Tornwald states that a sac or canal is present in the great majority of cases.

In view of these conflicting statements, SCHWABACH examined this region in 53 subjects, 28 being infants or young children, in whom alone a normal pharyngeal tonsil is to be seen, and in no case did he find a bursa as described by Luschka, while Ganghofner's account is fully confirmed.

In the young subject the pharyngeal tonsil is divided by fissures into ridges of variable height, which are directed for the most part more or less obliquely. On most preparations two ridges close to the middle line are more prominent than the rest, and enclose a central furrow of corresponding depth. In some cases, however, there is a median ridge dividing this furrow. At the back of the median furrow or ridge there is generally a slight depression about the size of a pin's head, and in four instances it took the form of a recess 2 or 3 mm. deep. A small transverse fold of the mucous membrane sometimes divides this depression into anterior and posterior parts, or separates it from the groove. In several cases there was no trace at all of this hollow; and in no instance was it more than a superficial depression of the mucous membrane devoid of any connection with the bone.

In the adult there are usually but few indications of the original conformation of the tonsil, the median cleft and its bounding ridges being the parts most frequently retained; but even when all the ridges have disappeared, the furrow is still represented by a slight fossa or a canal bridged over by the mucous membrane. Such bridges of mucous membrane are of frequent occurrence on the pharyngeal tonsil, on the roof of the pharynx, and in the recess of Rosenmüller; and the cavities may also be completely enclosed by mucous membrane giving rise to cysts. The descriptions of the bursa given by Luschka and Tornwald are regarded as relating to pathological states.

It has been shown by Dursy and Froriep that the recessus pharyngeus medius is not connected with the formation of the hypophysis cerebri; and the latter writer considers it probable that it is related to the retropharyngeal chorda. On this point Schwabach promises a further communication dealing with researches now in progress.—*Archiv für microskop. Anat.*, Feb. 1887.

ON THE CLOSURE OF THE CARDIAC ORIFICE OF THE STOMACH.

It was observed by Braune that water injected in considerable quantity into the stomach through the œsophagus, with the body in a horizontal position, does not flow out again, although no ligature is applied. To explain this phenomenon, A. v. GUBAROFF, working in Braune's laboratory, investigated the mechanism by which the cardiac orifice is closed. In part the closure is to be explained by the action of the diaphragm, the fibres of which form a sphincter around the œsophageal opening; but it is mainly due to a valve-like arrangement dependent on the relation of the ending of the œsophagus to the stomach.

In a frozen section, the stomach being distended, the lower end of the œsophagus is seen to be bent sharply to the left, the fundus of the stomach extends upward considerably beyond the cardia, and the left margin of the latter projects toward the right or lower border in the form of a rounded edge or fold containing a thick bundle of fibres of the diaphragm. When water is injected under a low pressure into the stomach from the duodeno-jejunal flexure, it does not flow into the œsophagus so long as the parts are in their natural position; but if the stomach is drawn downward, so as to stretch the angle between the œsophagus and the fundus, the fluid enters the gullet. In the child the œsophagus takes a straighter course to the stomach, and the facility with which food regurgitates in the infant is thus accounted for. Perhaps the varying readiness with which vomiting occurs in different people is to be attributed to the degree of development of this valvular structure.—*Archiv für Anatomie*, February, 1887.

ON THE POSITION OF THE DUODENUM, OF THE ILEOCOLIC JUNCTION, AND OF THE SIGMOID FLEXURE.

P. SCHIEFFERDECKER publishes observations on the variations in position of certain parts of the intestinal canal, collected during the dissection of about two hundred bodies in Rostock and Göttingen. In the duodenum the only noteworthy class of deviations relates to the length of the second part, and the consequent level at which the third part crosses the spine. This may be as high as the disk between the second and third lumbar, or as low as the top of the fifth lumbar vertebra. The situation of the duodeno-jejunal flexure is very constant.

The opening of the ileum into the large intestine is most frequently placed on a level with, and a little to the outer side of the right sacroiliac articulation. A lower position is often met with; and occasionally it lies in the cavity of the true pelvis. Only two cases were met with in which the ending of the ileum had a markedly higher position than usual; in one it was opposite the third lumbar vertebra; and in the other in front of the kidney, on a level with the second lumbar vertebra, so that there was practically no ascending colon. In both these instances the other abdominal organs were normal, and the testicles were in the scrotum.

The position of the sigmoid flexure is very variable, and the different forms are collected into four groups, as follows:

I. The flexure lies to the inner side of the descending colon.

a. The loop hangs down in the pelvic cavity. This is regarded as the normal form as shown by the developmental history, and by its being mechanically the most natural.

b. The loop is turned upward and applied to the posterior abdominal wall. In one extreme case the loop ascended on the side of the spine to the left kidney, being fixed here by the peritoneum; and in another the loop, having a free meso-sigmoideum, crossed the middle line and reached the right iliac fossa, where it touched the cæcum. Between these extremes all intermediate forms occur.

c. The loop is directed upward, but other parts of intestine intervene between it and the posterior wall; and it may come in contact to a greater or less extent with the anterior wall. These cases are very frequent.

II. The flexure lies to the outer side of the descending colon. Only one example of this condition was met with; and it is probable that it differs in kind from the foregoing groups, being not merely an irregular position of an identical loop, but a loop formed in the intestine immediately above the situation of the normal one which is undeveloped.—*Arch. für Anat.*, Feb. 1887.

ON THE RELATIVE LENGTH OF THE FINGERS AND TOES.

W. **BRAUNE** contributes some interesting observations on the form of the hand and foot in a paper contained in the volume recently dedicated to C. Ludwig by his pupils. It is well known that in works of art the hand is generally represented with the index finger more prominent than the ring finger, whereas in nature such a form is only met with exceptionally. But the attempt to estimate the length of the several fingers by inspecting the hand, or even by tracing the outline on paper, after Ecker's method, is fallacious; and only direct measurements of the bones yield trustworthy results. Braune gives a table of the length of the metacarpal bones and phalanges in 93 hands, in 39 of which the bones were still united by their ligaments, while the remaining 54 were artificially mounted. In the following statistics the latter group is not taken into account, since there may be doubt as to the proper position of some of the bones.

Taking the metacarpal bones and phalanges together, the index finger is longer than the ring in 27, and shorter in 10, while the two are equal in 2. In all the second metacarpal bone is longer than the fourth, and the phalanges of the ring finger are longer than those of the index finger. The first phalanx of the index is the longer in 33, of the ring finger in 3, and the two are equal in 3. The middle phalanx of the ring finger is the longer in all. The last phalanx of the ring finger is the longer in 34, that of the index in 4, and in one case the two are equal.

The greater length of the index finger as a whole thus depends entirely (as was pointed out by J. Marshall, in his *Anatomy for Artists*, 1887) on the length of the metacarpal bone. The greater prominence of the ring finger usually seen in the hand is attributed by Braune to a lateral inclination of the fingers to the ulnar side, due primarily to the oblique pull of the flexor muscles. The hand with a longer index finger is the higher form; not simply by reason of contrast with the hand of the ape, but because it is thereby better fitted for the special work of man.

In the same way, the foot is generally represented by artists with the second toe projecting beyond the first, but in the natural foot the great toe almost always appears the most prominent. This appearance is, however, a result of the flexion of the second toe, caused by the pressure of the shoe; and if it be carefully straightened, the second toe is generally found to be the longest. Of 37 students of his class, Braune found the second toe longer in 26, the great toe longer in 6, and the two of equal length in 5. In children and people who go barefooted the second toe is the longest.

The characteristic forms of the hand, with its longest third digit, and of the foot, with its longest second toe, are evident at a very early period in the fœtus. Whether there is any variation in the proportions referred to among different races of men, as assumed by Ecker, Kollmann, and Park Harrison, the material at present available is insufficient to show.

PHYSIOLOGY.

UNDER THE CHARGE OF

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Visual Centres of Cerebral Cortex.

Prof. Sigm. Exner and Dr. Joseph Paneth found defective vision, lasting some weeks after the operation, to follow removal of parts of the sigmoid gyrus of the dog. This was observed in five out of six animals. In that in which there was no defect of vision the lesion was just in front of Munk's centres. They therefore agree with those authors who deny that the visual functions are to be restricted to the posterior parts of the convexity of the brain.—*Pflüger's Archiv*, Bd. xl. p. 62.

Irritability of the Various Layers of the Cerebral Cortex.

Drs. Ernst Asch and Alfred Neisser experimented on rabbits to determine whether gray surface tissue or the underlying white substance of the motor regions of the brain be the more easily excited by electric stimulation. They conclude that in the track from the surface to the deeper parts of the brain there exists a point the stimulation of which is followed by much more active movements than if any other part of the path of the impulse be similarly stimulated. This point is the boundary between the gray and white substance, and most probably it really is the innermost layer of the gray matter. With weak stimulations, the electrodes piercing the gray matter, the authors frequently found movement of the limbs on the same side of the body as the stimulus was applied to the brain.—*Pflüger's Archiv*, Bd. xl. p. 191.

Intracardiac Pressure.

J. Magini estimates the variations in the blood-pressure within the heart of dogs by means of a special trocar pushed through the apex. The position and surroundings of the organ were but little disturbed by the operation, which was borne well by the animals, so that the investigation could be continued sometimes for an hour. Only twice in twenty-one operations did insurmountable complication arise. The trocar was connected with a manometer and cardiographic apparatus by means of a thick-walled caoutchouc tube filled with soda solution. The action of the valves thus escaped the interference with their function inseparable from Marey's mode of procedure.

The pressures were generally rather higher than those found by other observers, and the curves free from the secondary variations which are so marked on Marey's tracings. A negative pressure was found in the pericardium equal to thirty mm. of mercury.—*Arch. Ital. de Biologie,* t. viii. fasc. i. p. 125.

THE UNION OF CARBONIC ACID WITH HÆMOGLOBIN.

By comparing the amount of CO_2 taken up by water—which follows Henry's law—with that taken up by solutions of hæmoglobin, CHRISTIAN BOHR shows that considerable volumes of CO_2 may be made to unite with the coloring matter of the blood. One gramme of pure hæmoglobin combines with about 3.5 c. c. CO_2 at a pressure of 120 mm.—*i. e.,* more than double the quantity of oxygen that can be taken up. The combination is readily dissociated, for the quantity existing in the solution diminishes rapidly as the pressure is lowered. The maximum absorption is reached within the degree of pressure named above. Stronger solutions take up less per unit of hæmoglobin than weak solutions. No decomposition of the hæmoglobin occurred.—*Beiträge zur Physiologie, C. Ludwig gewidmet,* 1887, p. 164.

THE COAGULATION OF THE BLOOD.

L. C. WOOLDRIDGE obtains blood from a dog immediately after the injection of peptone, which does not undergo coagulation, though kept till it decomposes. In the clear plasma separated from this by means of the centrifugal machine, two complex bodies can be shown to exist, which are both coagulable, and by whose inter-action fibrin is produced. He names them A. and B. fibrinogen, and supposes them to be a mixture or combination of albumen with lecithin. The A. fibrinogen can be precipitated from the clear plasma by cooling. It appears as small, round, colorless masses which readily combine to form a fibrinous material. In the presence of this body the plasma is easily made to coagulate, the existence of fibrin ferment having apparently no influence. If the A. fibrinogen be removed, the B. fibrinogen will not coagulate without the addition of some substance containing lecithin. B. fibrinogen, therefore, cannot be the same body as Hammarsten's fibrinogen, since the addition of fibrin ferment does not induce its coagulation; but by repeated precipitation with acid and resolution in weak alkalies, it assumes the properties of that body. The clear plasma, freed from all form elements by the centrifugal machine, contains all the ingredients necessary for spontaneous coagulation. The ferment which appears during coagulation is said to be the result and not the cause of the clotting, which depends upon some transfer of lecithin taking place from one kind of fibrinogen to the other. Other kinds of fibrinogen are said to exist in the tissues of the body which can cause coagulation either within or without the bloodvessels.—*Beiträge zur Physiologie, C. Ludwig gewidmet,* 1887, p. 221.

MATERIA MEDICA, THERAPEUTICS, AND PHARMACOLOGY.

UNDER THE CHARGE OF
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Acetanilid (Antifebrin).

This promising contribution to our therapeutical resources has recently been the subject of an elaborate investigation by Weill (*Bull. Gén. de Thérap.*, Feb. 28, 1887). He arrives at the following conclusions in regard to its physiological actions: It acts especially on the nervous system, and after a period of excitation is followed by depression and collapse; it induces general anæsthesia and analgesia; it causes a notable increase in the intravascular blood-pressure by contracting the peripheral arterioles; it lowers the central and peripheric temperature, and in a toxic quantity seriously impairs the composition of the blood, changing hæmoglobin into methæmoglobin.

On the foregoing conclusions respecting the physiological actions of acetanilid, Weill bases the therapeutical applications. He has formulated the following opinions as to its therapeutical uses:

Acetanilid is an active febrifuge. It has the highest utility in almost all diseases of which the one symptom to be relieved is elevated temperature.

It acts efficiently in all nervous affections characterized by a morbid excitability of the reflex functions—as, for example, epilepsy.

It does not increase but rather diminishes the flow of urine.

Habit is set up by uninterrupted and prolonged administration.

Acetanilid, as antifebrin, has also been the subject of investigation by Prof. Lépine, who enlisted Prof. Charcot in its clinical study. As a remedy for the pains of locomotor ataxia, and for the trembling of sclerosis, it was found to relieve many, and to remove the symptoms entirely in a few. Having the power to diminish the reflex excitability of the spinal cord, it was also used in cases of epilepsy with considerable success.

Grunneberg (*Berl. klin. Wochenschrift*, p. 849, 1886) reports the result of his use of antifebrin in typhoid. He finds it very effective when a considerable reduction of temperature is to be made. Although it may cause profuse sweats and severe chills preceding the rise of temperature, the action, for the most part, is free from unpleasant symptoms. He has given 2 grammes (ʒss) a day without inconvenience, but 50 centigrammes (8 grains) have proved a sufficient quantity to reduce fever.

Dujardin-Beaumetz (*Bull. Gén. de Thérap.*, March 30, 1887) has also made a clinical investigation of acetanilid in continuation of the observations of Weill. As a febrifuge he does not regard it as an important contribution to our resources in this respect, and holds that it is much inferior to antipyrin for this purpose. It is in respect to its action on the nervous system that he commends its use. It is a remarkable fact that acetanilid does not influence temperature when administered in the apyretic stage, but during the height of the febrile exacerbation, even in moderate doses, it makes a considerable impression on the pyrexia, reducing fever heat several degrees.

Dujardin-Beaumetz has never exceeded 3 grammes (46 grains), and usually gives no more than three or four doses of 50 centigrammes each (8 grains) in the course of twenty-four hours. He has employed it for the relief of three conditions, namely: for pain in general, for the pains of locomotor ataxia, and for epilepsy.

In facial neuralgia it is inferior to aconite, but when structural alterations are taking place in the nerve, as in neuritis of the optic, acetanilid is superior to all other remedies. In muscular rheumatism and neuralgia, and in neuralgia of the articulations, he has found it superior to the salicylates. Also, in the flying pains of tabes it seems to be peculiarly effective. Sometimes the effects are lasting, but in other cases the remedy loses its influence after long-continued use.

In epilepsy Dr. Dujardin-Beaumetz finds acetanilid a useful remedy. Recognizing the uncertainty which must attend the exhibition of a new remedy in this malady, so much influenced by mental impressions, a degree of reserve is necessary in accepting favorable conclusions. In his own hands and in the experiences of others, especially of Prof. Grasset, of Montpelier, some remarkable results have been obtained. With due reserve, and making allowances for error, there is yet sufficient evidence to show that acetanilid is a valuable addition to the remedies now employed in the treatment of epilepsy.

We add to the foregoing observations on acetanilid, or antifebrin, some studies of its therapeutical action made by H. EISENHART in Ziemssen's Clinic, which appear in the *Centralblatt für die gesammte Therapie* for April, 1887. Eisenhart reports on thirty cases of disease, including typhoid, acute rheumatism, pneumonia, some eruptive fevers, and other febrile disorders. The doses usually administered ranged from four to eight grains. The effects are observed in about two hours, and the reduction of temperature amounts to 1° to 4°, the maximum impression occurring in three to four hours. The normal temperature is little, if at all, affected by it, and hence, as has been observed by others, it should not be administered in the apyretic stage, but rather at the time of greatest heat. The duration of the antipyretic action ranges from four to fourteen hours. As is the case with antipyrin, antifebrin causes profuse sweating; but it is well borne, does not cause nausea or vomiting, and is readily taken.

In acute rheumatism, as compared with antipyrin, Dr. Eisenhart finds it inferior, and it is also less curative than the salicylates; but he admits that it is a valuable antipyretic in general, and especially in typhoid. He expresses the conviction that the course of typhoid is rendered milder and its duration lessened by the administration of antifebrin.

ANTISEPTIC HYPODERMATIC INJECTIONS.

So much has been published of late on this important subject that our readers may desire more exact information than has hitherto been furnished. The oil of vaseline which is used as the vehicle is obtained better from Russian petroleum. It is described by DR. LEY, who pursued his investigation in the laboratory of Dujardin-Beaumetz (*Bull. Gén. de Thérap.*, March 30, 1887), as a colorless, inodorous, tasteless, oily fluid, neutral in reaction, and of a density varying between 0.820 and 0.880. It causes no pain or induration when thrown under the skin. It dissolves the essential oils in equal parts, and such substances as iodine, bromine, sulphide of hydrogen, carbolic acid, iodoform, iodol, sulphide of carbon, and by some special manipulation, a large number of the alkaloids, as morphine and cocaine, in varying proportions. When thrown under the skin, oil of vaseline diffuses rapidly, and as quickly conveys the medicaments incorporated with it, through the system.

The clinical studies were made in the wards of Dujardin-Beaumetz in the Cochin Hospital, and the results derived from various agents used in this way are set forth in the communication from which we now quote. The solution of iodine gives some admirable results in cases of emphysema and asthma and bronchial catarrh; the cough diminishes, the expectoration lessens, the sense of oppression ceases, the appetite is restored, and sleep is again enjoyed. Solutions of carbolic acid and eucalyptol have been tried in a great many cases of chronic bronchitis and pulmonary tuberculosis. In some examples of the latter the injections caused too much excitement and fever to be persevered in; but in those of a chronic and subdued character, with little fever, eucalyptol had good effects, diminishing the cough and expectoration, modifying the sputa, lessening the sweats, and restoring sleep and appetite; but it was much less useful and sometimes injurious in more acute cases, more nearly approaching the type of phthisis florida.

The solutions of carbolic acid administered subcutaneously, and the same combined with iodine, produced surprising results. At the outset, however, the progress was slow, but the improvement continued, and even in unfavorable cases the results have been highly satisfactory—for not only in respect to the rational signs of phthisis has the most marked improvement taken place, but the *bacillus* is gradually made to disappear.

Dr. Ley concludes as follow: The pure mineral oil, now known as the *oil of medicinal vaseline*, is a very useful vehicle for making solutions to be employed subcutaneously. The oil of *arachides* (?) is, of all vegetable oils, the best adapted to the same purpose.

Of the medicaments subjected to experimental trials, iodine and carbolic acid occupied the first place, eucalyptol and sulphide of carbon coming after.

The injections containing eucalyptol had the strength of 20 to 50 per 100. The medium dose is 60 to 75 centigrammes (about 10 to 15 grains). After fifteen to twenty days use of the remedy, an intermission of a few days is desirable, or for the eucalyptol some corresponding remedy may be substituted, such as terpinol, terebinthin, etc.

Eucalyptol administered hypodermatically is quickly absorbed, and is eliminated largely by the lungs, but some accumulation takes place in the system, a fact that must be kept in mind. It does not affect the fever of pulmonary tuberculosis, but acts on the bronchial mucous membrane, and exerts a distinctly curative influence in the catarrhal affections of the bronchi. Its action is local, but it does not affect tubercle. Carbolic acid is a more efficient antiseptic, and when combined with iodine, has a very pronounced effect on bronchial catarrh.

In grave cases, better results are had from the administration of iodine and carbolic acid, the effects of which are uniform and persistent.

EFFECTS OF IODIDE OF POTASSIUM ON THE ASSIMILATION OF NITROGENOUS MATERIALS.

Contradictory opinions have been expressed as to the action of iodide of potassium on the assimilation and metabolism of nitrogenous matters. Bock long ago (1869) maintained that it has no effect of this kind, but subsequently Smirnow demonstrated that it does promote the disassimilation of nitrogenous substances. Recently SAMOÏLOW has examined the question anew (*Thesis of St. Petersburg,* 1886) by a series of laboratory experiments, dogs being used for the purpose, and he concludes that small doses of potassium iodide promote the function of assimilation, but large doses act in the opposite manner, increasing the destructive metamorphosis of the nitrogenous tissues or materials. No doubt the waste caused by this agent may be in part due to its action on the mucous membrane—to the swelling and desquamation of the epithelium and thrombosis of the smaller vessels of the kidneys—hence Samoïlow holds that the large doses of iodide of potassium recommended by Keyes are dangerous.

EFFECTS OF ALCOHOL ON THE DIGESTIVE FUNCTIONS IN THE NORMAL AND IN THE PATHOLOGICAL STATES.

DR. A. GLUZINSKI has examined anew this much debated question (*Deut. Archiv f. klin. Medicin,* vol. 39, 1886). His conclusions are as follows:

Alcohol disappears rapidly from the stomach. Two phases of the effects on digestion are to be noted: in the first, there is a marked diminution in the power to digest albuminous substances; the second phase commences after the elimination of the alcohol, and during this period the functional activity of the stomach is such that digestion is completed somewhat earlier than in the normal state. Alcohol in the first phase, inhibits the activity of pepsin, but, on the other hand, stimulates the gland elements, in consequence of which during the second phase there is a more abundant production of hydrochloric acid. Dr. Gluzinski finds, therefore, that a small amount of alcohol exerts a favorable influence on the digestion of healthy persons.

In diseased states, after the absorption of a certain amount of alcohol, the two phases of digestion are much less pronounced, and hence the use of alcoholic drinks is not to be recommended in such morbid conditions of the digestive apparatus as dyspepsia.

PILOCARPINE IN CATARRH OF THE TYMPANUM.

KOSENGARTEN has recently reported the good effects obtained by him in catarrh of the middle ear, by subcutaneous injections of pilocarpine (*Zeitschrift für Ohrenheilkunde*, 1886, vol. xiv., quoted in *Bull. Gén. de Thérap.*, April 15, 1887).

Politzer was the first to call attention to the use of pilocarpine in recent affections of the labyrinth, and these observations were confirmed subsequently by Moos and Wolff, and still more recently by Jacobson. Kosengarten conceived the notion of making pilocarpine injections in chronic troubles of the middle ear, and they have proved to be highly useful.

THE HYPODERMATIC INJECTION OF THE INSOLUBLE SALTS OF MERCURY.

The treatment of syphilis by the subcutaneous injection of mercurial salts yet remains an undecided question. In an elaborate historical and critical review of the subject, DR. GUELPA seeks to establish some principles for more accurate guidance (*Bul. Gén. de Thérap.*, April 15, 1887).

The method of Scarenzio, set forth in his great work, has been the point of departure in recent times in the therapeutical applications of mercury subcutaneously. Calomel and the yellow oxide are the mercurial salts employed by him, and his conclusion was that the hypodermatic method is superior to friction or fumigation. The next most important contributions to the subject were made by SMIRNOFF, who occupied himself with determining the best site for the injections, as well as the general principles applicable. Smirnoff advises that the depression in the hip behind the great trochanter be selected for the operation, because here the areolar tissue is abundant, loose, and extensible. Suitable care taken, abscesses do not form, and the pain and discomfort are reduced to the minimum. If mercurialism occur, Smirnoff holds that it is due to impure air, and the mercurial vapor generated in an apartment occupied by many subjects undergoing the mercurial treatment. It follows that careful attention to ventilation and to the supply of pure air becomes necessary to success.

Smirnoff concludes that the hypodermatic method is required where prompt results are necessary; that it is contraindicated when mercurial periostitis has appeared; that it is the most convenient and simple of the methods used; that it is applicable to all ages and stages of the disease; that it is superior in efficacy to the treatment by inunction, and more active than any other mercurial plan.

Dr. Guelpa, in concluding his memoir, states that he has not yet attained to a final conviction on the subject, but he expresses the opinion based on an unprejudiced examination of the question, that the hypodermatic injection of the salts—especially, perhaps, of the insoluble salts of mercury—must be regarded as a method of treating syphilis of general utility, and in a special case incontestably superior to all other plans.

THE PREVENTIVE TREATMENT OF SYPHILIS.

PROF. NEUMANN has recently published the results of his clinical work in this department (abstracted in the *Bull. Gén. de Thérap.*, Feb. 15, 1887). The so-called "preventive treatment" consists in excision of the induration and mercurial inunctions. Neumann finds that extirpation of the local disease does not prevent general infection, nor does the mercurial inunction prove more efficient in this respect.

The expectant treatment is rejected by him because of the great length of time required, because such subjects continue to be a source of infection, and because the ulterior accidents are often very serious in character.

FINGER, of Vienna, although regarding excision as possibly successful, thinks it hazardous on the whole. He is opposed to the preventive method and expectancy, and still maintains the superiority of iodine and mercury in the treatment of all the manifestations of syphilis.

TREATMENT OF NEURALGIA OF THE FIFTH NERVE.

PROF. GUSSENBAUER (*Prag. med. Wochenschrift*, No. 31, 1886, quoted) remarks that trigeminal neuralgia is very frequently a reflex action proceeding from the intestines in the course of an obstinate constipation. In 33 cases under his observation there were but 3 requiring surgical interference, and in the others cures were obtained by methodical treatment of the constipation. In most of the cases sensible amelioration occurred in about fifteen days of the treatment. The measures employed consisted in cold enemata, fomentations, and cold frictions of the abdomen.

COCAINE IN CARDIAC ASTHENIA.

NOORDEN (*Berliner klin. Wochenschrift*, No. 51, 1886) has had good results (*vêritablement merveilleux*) in pseudo-angina pectoris by the use of cocaine. He offers no explanation of its utility, but compares its action in these cases to that obtained by Bescharner in bronchial asthma.

THE FORMIATES AND THEIR DISPOSAL IN THE ORGANISM.

MM. GRÉHAUT AND QUINQUAD publish in the *Archives de Physiologie*, April 1, 1886, an elaborate research on the disposition made of the formiates when introduced into the body. (*Recherches sur les Formiates Introduits dans l'Organisme.*) It will suffice to give their conclusions. Although not a matter of immediate practical importance, the facts may serve to explain, or suggest by analogy, how similar substances act under corresponding conditions.

MM. Gréhaut and Quinquad conclude that when formiate of soda is introduced into the digestive canal or thrown into the blood, it is eliminated by the kidneys without undergoing decomposition, and that the urine contains no more than the usual proportion of carbonates.

HOT WATER IN ACUTE PROSTATITIS.

DR. CAZEAUX (*Thèse de Paris*, 1886) finds that hot water enemata and applications to the perineum are very effective at the onset of prostatitis and before the occurrence of suppuration. He advises water at the temperature of 130° F., to be used by the irrigator three times a day to the perineum and in the rectum.

MASSAGE IN SCIATICA.

PROF. MAX MÜLLER advocates the methodical use of massage in sciatica. (*Deut. medinis. Wochenschrift*, No. 24, 1886.) Of a group of fifteen patients of varying ages, he succeeded admirably in all by this treatment. All of them were severe cases, having intense pain and considerable disorder of motility. Massage was applied in the ordinary way, the patient lying on the healthy side. The first *séances* were painful, but the irritability of the nerves rapidly subsided, and after a few treatments no pain was caused by it and permanent relief was obtained.

SPARTEINE.

This new cardiac remedy, so much praised by Prof. Germain Sée, has been studied by DR. STOESSEL, of Vienna, and his observations appear in the *Centralblatt für die gesammte Therapie* of April, 1887.

After a statement of the opinions given by Sée, Dr. Stoessel narrates his own experiences. In respect to the value of sparteine in the condition of arhythmia of the heart, due to weakness of the heart-muscle, he does not agree with Prof. Sée, who maintains that it is superior to digitalis here. Especially does Dr. Stoessel find sparteine inferior to digitalis in the irregular rhythm and weakness due to fatty degeneration of the heart.

Another fact, showing the superiority of digitalis, is that this remedy is an efficient diuretic, while sparteine has little or no action on the kidneys.

SALOL.

In the *Therapeut. Monatsh.*, p. 47, 1887, Bielchowski publishes the results of his experience with salol in acute rheumatism. In the quantity of 5 grammes a day (75 grains) it acts promptly in arresting the disease, and, when a relapse occurs, a single dose will usually prove immediately successful.

Rosenberg has also employed it with complete success. Its advantages are, that it does not disturb the digestive organs, and is not difficult to administer; but the chief point is, the curative power, which is so much greater than the salicylates have, but there is no evidence to show that it succeeds better than other agents in preventing the cardiac complications.

We submit some further observations on salol, that our readers may have the data for forming correct conclusions. A full abstract from a paper by DR. FR. EDUARD GEORGI, is published in the *Centralblatt für die Therapie* for April, 1887, from which we obtain the facts here given.

As regards the topical use of salol, Dr. Georgi did not find it superior to the remedies now employed for the relief of nasal and pharyngeal diseases. By the stomach it may be given in doses of 10 to 30 grains without inconvenience. In a case of febrile icterus it had a rapid effect, both in reducing the fever and clearing up the jaundice. It proved to be effective in lessening the temperature of the phthisical also.

In pyonephritis, cystitis, etc., it was found to be very active in checking suppuration, and preventing and removing the products of decomposition of the urine.

In acute rheumatism Georgi ascertained it to be exceedingly valuable, one or two doses often relieving the pain entirely, and in all cases relief was obtained in two or three days. Two grammes (30 grains), in the twenty-four hours, were found to be sufficient, and it was rarely necessary to administer more than ten to twelve grammes (150 to 180 grains), in all, to effect the removal of the rheumatic pains. When this was accomplished, the dose was reduced to 15 grains a day until complete recovery. Relapses were not frequent. The largest dose given caused no unpleasant sensations, and only in three out of twenty cases was buzzing in the ears brought on. Weakness of the heart, small pulse, or indications of collapse, never occurred. As an antipyretic in febrile disease salol proved to be certain in its action and powerful, but massive doses are necessary—from 30 to 60 grains. Unlike the other antipyretics of this group, salol induced but moderate perspiration.

Iodol and Iodoform.

Schnirer makes (*Semaine Médicale*, 1886, p. 406, quoted by *Bull. Gén. de Thérap.*, February 15, 1887) some observations on the comparative utility of iodoform and iodol.

As the odor of iodoform is so strong, diffusive, and penetrating, iodol is a happy substitute, since it has but little taste or odor. It is a brown powder, which may be used topically, or taken internally, in the quantity of 25 to 50 centigrammes (4 to 8 grains). Experience has confirmed the original statements as to its utility. It is equally effective with iodoform, and can be substituted for the latter in the whole range of the topical uses, and probably, also, for internal administration.

Chlorhydrate of Péreirine.

In a recent communication (*Bull. Gén. de Thérap.*, April 15, 1887) Dr. Ferreira, of Brazil, calls attention to the power of *chlorhydrate of péreirine* in the cure of malarial infection. This alkaloid is obtained from a member of the Apocynaceæ, which grows spontaneously and in great abundance in Brazil. The dose prescribed by Dr. Ferreira is two grammes (about ʒss), in two parts, at a half-hour interval. He finds it an efficient antiperiodic, less irritating to the stomach than quinine, and sometimes successful when quinine has entirely failed. It appears to be more useful in the acute cases.

MEDICINE.

UNDER THE CHARGE OF
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On some Cases of Infectious Cerebro-spinal Meningitis, with Remarks on the Diagnosis of the Disease.

Senator (*Charité Annalen*, xi. 248, 1886) reports eight cases of this affection, and emphasizes the difficulty attending its diagnosis. The disease can be most easily confounded with typhoid fever, tetanus, and with other forms of meningitis cerebro-spinalis. But even in cases of cerebral hemorrhage into the meninges or ventricles, where decided stiffness of the neck is combined with spasm and contractures of the extremities, a confusion with cerebro-spinal meningitis may arise, especially as absence of the tendon reflexes is observed in severe cases of the latter affection.

Acute rheumatic arthritis of the articulations of the vertebral column, narcotic poisons and those producing spasm, uræmia, diabetic coma and the nearly allied coma of other dyscrasic conditions, are also to be borne in mind in forming a diagnosis. The previous history of the disease in each case is of the greatest importance, since in other disorders the symptoms usually do not occur in the same order as in cerebro-spinal meningitis. At the height of the disease there are to be observed a stiffness of the neck, various eruptions of the skin—especially herpes, fever, and sweats which are not critical. The swellings of the joints, which develop later in the disease, are of diagnostic import. In one case it was observed that the diazo reaction was absent. This feature, if confirmed, would be of importance as distinguishing the disease from typhoid.

Mountain Fever.

In a "Report on the Topography, Botany, Climatology, and Diseases of Surprise and Goose Lake Valleys, California," by Kober, we find a short notice of mountain fever. He says that it differs essentially from the clinical pictures of enteric and remittent fevers, and represents, he believes, a union of the typhoid and malarial poisons. The disease is ushered in by a chill or chilly sensation, repeated during two or three days. There is some aching of the head and of nearly every part of the body. The tongue is covered with a thick yellowish or bluish fur, but with the borders and tip clean and red. Often there is slight pharyngeal and nasal catarrh. The temperature reaches 101°–104° F., and in the first stage of the disease especially exhibits marked exacerbations and remissions, suggestive of quotidian and remittent fevers. The pulse is 90–110 and full; epistaxis and abdominal symptoms are rare in the early stages; there is no eruption; herpes is common; sweating more common than in typhoid. The fever continues four or five weeks, and in the graver forms abdominal and adynamic symptoms develop. Early treatment usually cuts the disease short; but if neglected, it runs into the typhoid stage and quinine has no curative influence. He has often seen the disease attack men who have lived in places where it seems impossible that the typhoid germ could have existed. He thinks it likely that this was obtained from the pollution of some of the mountain streams by beaver dams and large game. The author agrees with Hoff (Amer. Journ. Med. Sci., for January, 1880), who, following Woodward, calls the affection typho-malarial fever, and believes that it is a hybrid disease—*i. e.*, typhoid, modified by intermittent. He says that it begins as an intermittent, and that this stage is followed in two weeks by the typhoid stage, which lasts about four weeks, and exhibits the typical typhoid symptoms. A postscript by Woodward confirms him in the statement that necropsies almost always reveal the lesions of typhoid.

This would seem to be conclusive, but it is but right to say that opinions are somewhat divided. Smart (Amer. Journ. Med. Sci., 34, 1878) claims that mountain fever is only a malarial remittent with adynamic tendencies. Hirsch (*Handb. of Geog. and Hist. Path.*, Eng. transl., 1883) refers to it as a variety of malaria. There is also some unfortunate confusion in the name employed. SQUIRE, in the last number of this journal, describes typho-malarial fever as malarial fever which has assumed the adynamic type present in typhoid fever, and applies the name "malarial enteric" to those cases in which there is a union of both diseases, as seems to be the case in mountain fever.

THE MICROÖRGANISMS IN THE VARICELLA VESICLE.

GUTTMANN (*Virchow's Archiv*, B. cvii. H. 2, 259) has investigated the contents of the vesicles in three cases of varicella, with regard to the presence of bacteria. In cultures made upon agar-agar, he discovered three varieties of cocci: 1st, the Staphylococcus aureus; 2d, one which he names Staphylococcus viridis flavescens, which is characterized upon the culture medium by a color at first resembling that of an unripe lemon, and later becoming more yellow. It is never white; 3d, a coccus exhibiting on agar-agar culture a white color.

Inoculations of these cultures upon animals were without result, except in the case of the Staph. aureus, which proved fatal in one instance. Guttmann believes that cocci of various other species may occur in the varicella vesicles, and refers to a species previously reported by Bareggi.

PERIPHERAL NEURITIS.

In discussing this subject in the *Brit. Med. Journal*, 1887, p. 6, Ross says that the symmetrical manner in which the disease usually attacks the body shows that at least in the majority of cases it is produced by some poison in the blood. Thus salts of lead, arsenic, and probably of copper and other metals are capable of giving rise to it. In a second group of cases the disease is caused by alcoholic excess, the fumes of bisulphide and oxide of carbon, and probably by the abuse of chloral and chloroform. It has also been observed in advanced diabetes. A third variety arises from animal poison. Diphtheritic paralysis is the best known instance of this. It is also to be observed in syphilis, smallpox, scarlet fever, measles, typhoid, typhus, intermittent fever, dengue, tuberculosis, leprosy, and beri-beri. It is probable that it may be caused by rheumatism, and that the wasting of the extensors seen in chronic rheumatoid arthritis is due to a neuritis of the neighboring nerves. There is also an *idiopathic* multiple neuritis.

The symptoms consist in more or less widely distributed atrophic paralysis. Ross has never been able to assure himself that active spasm preceded the paralysis in any case. The condition of the cutaneous reflexes varies. With a very few exceptions, the patellar reflex has been wanting in all recently reported cases of alcoholic, diphtheritic, and other forms of neuritis of the lower extremities. The knee-jerk is sometimes absent in lead poisoning, even when the muscles of the lower extremities are not appreciably involved. Yet the failure of the patellar reflex is a valuable but not an absolute sign of neuritis. The electrical test affords conclusive evidence in the majority of cases. The faradic excitability of the affected nerves and muscles is lessened or abolished, and the reaction of degeneration is detected with the galvanic current. The paralysis affects especially the extensors, as is well seen in the "wrist-drop" of lead palsy. That following alcohol, bisulphide of carbon, the animal poisons, and even arsenic, usually attacks the extensors of the lower extremities first. Paralysis of the extensors of the forearm soon follows in alcoholic neuritis, then the thighs and upper arm, then the flexors of the leg and forearm, and finally even the muscles of the trunk may become involved.

In diphtheritic paralysis the soft palate is the first to be affected; then the muscles of the eye, and after some time the lower extremities. The arms are seldom involved.

The paralysis of the extensors in neuritis produces a temporary or permanent flexion of the limb, simulating a spasm of the flexors.

The sensory disturbances accompanying the paralysis resemble considerably those of locomotor ataxia.

The disease may most easily be confounded with chronic poliomyelitis, Landry's paralysis, and locomotor ataxia. From the first it is distinguished by the presence of well-marked sensory phenomena, and by the order in which the muscles are attacked. From the second it differs in exhibiting the reaction of degeneration with marked sensory disturbances and wasting of the muscles. From the third it differs in many respects, but the character of the gait is sufficient to distinguish it. We observe, namely, in neuritis a peculiar elevation of the knee in walking, with a drooping of the toes, and an unusual exposure of the sole of the foot to one standing behind the patient. Such a case is unable to elevate the toes if sitting on a chair with the soles flat on the floor.

As regards the pathological anatomy of the disease, the author shows that opinions are now generally agreed that the lesion is seated in the nerves themselves and not in the cord.

On Pseudo-Tabes from Arsenical Poisoning.

Dana (*Brain*, xxxvi. 456, 1887) reports two cases and makes a careful study of the literature of arsenical paralysis, appending over 100 references. He concludes that there are two forms of this, just as there are of diphtheritic and alcoholic paralysis.

1. The ordinary arsenical paralysis, in which the motor affection and the atrophy are more marked than the sensory derangement.
2. Arsenical pseudo-tabes, in which there is no pronounced motor paralysis, but decided sensory disturbance, especially ataxia.

It is entirely improbable that either of these forms is due, as a rule, to a diffuse myelitis, but rather to a multiple neuritis; just as is the case in paralysis from lead, alcohol, diphtheria, and probably from other infections and poisons.

On the Early Recognition of General Paralysis of the Insane; and the Relation between this Disease, Tabes Dorsalis, and Disseminated Sclerosis.

J. Syer Bristowe, in an address reported in the *British Medical Journal* for 1887, p. 1, states that, although typical cases of general paralysis are easily diagnosticated, yet, in many instances, especially in the early stage, at a time when a diagnosis is so much to be desired, the recognition of the nature of the disorder is difficult, if not impossible.

He gives a synopsis of the symptoms, mentioning the fact that epileptiform attacks and other mental derangements may occur in all these disorders. In general paralysis of the insane the paralytic symptoms are most pronounced in connection with the organs of speech. The usual duration of the disease is said to be two or three years, but it is probable that early indications, consisting of slight degrees of some of the characteristic phenomena, may be detected by the careful observer years before the first outspoken symptoms become noticeable.

Bristowe reports a series of interesting cases of general paralysis, illustrating the occasional difficulty of diagnosis. In one patient, for example, with fairly characteristic signs of general paralysis were associated symptoms both of tabes and of disseminated sclerosis. In this and in several other cases delusions never occurred. He then describes three cases, probably of locomotor ataxia, in which, however, there was so much mental disturbance that the diagnosis might be open to question.

SUDDEN DEATH IN PLEURISY.

WEILL (*Rev. de Méd.*, 1887, 33–64) reports a case of sudden death in pleurisy, and gives the notes of twenty-six others gathered from the literature, and which seem to him to fill the conditions of an *exitus* truly sudden. He excludes all cases of death from increasing asphyxia lasting some hours; and omits, too, all those in which thoracentesis had been performed, and death followed immediately or more remotely. His conclusions are as follows:

1. Sudden death in pleurisy appears to be associated with certain lesions, of which the principal are—thrombosis or embolism of the heart and of the pulmonary artery; sudden œdema of the lung on the side non-affected with pleurisy; alterations of the myocardium. These last often escape notice at the autopsy, since they demand the aid of the microscope for their detection. In some cases no cause at all can be found.

2. Cases of death attributed to simple functional trouble, such as severe syncope; or to mechanical interference, as displacement of the heart, torsion of the vessels, the bending of the ascending vena cava at a right angle; or to hypothetical lesions, as capillary embolism of the brain; ought to be admitted with great reserve.

3. Sudden death may occur in the most diverse varieties of pleurisy. The affection may be on either side (oftener the right); acute or chronic; with the effusion increasing, stationary, or decreasing. The liquid is usually serous.

4. Pleurisy ending in sudden death may or may not be accompanied by peculiar symptoms. There may be increase of dyspnœa, premonitory syncope, and irregular pulse. Very often death occurs when the case appears to be making most satisfactory progress. It is usually produced by some sudden effort.

5. Treatment is, of course, useless, when we have to do, for example, with lesions of the myocardium. The prophylactic treatment in other cases is thoracentesis. It is indicated either in the acute or chronic stage if threatening symptoms be present, or if there be increase of the intra-pleural pressure.

ON CASES OF VALVULAR DISEASE OF THE HEART, EXISTING FOR OVER FIVE YEARS WITHOUT SERIOUS SYMPTOMS.

SIR ANDREW CLARK (*Brit. Med. Journ.*, 260, 325, 370, 1887) extracts from the clinical histories of his office patients since 1873, 684 cases in which there existed well-marked chronic valvular disease of the heart, not indicated by any symptom, and not interfering with the patient's health. A series of elaborate tables accompanies the text. Concerning the diseases for which the patients were receiving treatment, it appears that nearly one-half were affections of the digestive system, and about one-fifth diseases of the nervous system.

The author relates, by way of illustration, a number of very interesting and instructive cases, not included in the tables, showing that the evidences of the gravest cardiac lesions could coexist with excellent health.

Many of the patients had been told by physicians previously in attendance that they could live but a short time. To others the strictest rules of diet and of exercise had been given, with the result that both health and happiness suffered greatly. For all of these cases, Clark recommended a return to the ordinary hygienic *régime* necessary for the physiological conditions of life. He warns us, however, that this is only suitable to chronic and stationary cases. When the heart is irritable, irregular, or frequent; when the murmurs vary in character and intensity, or when there is any febrile action, patients must be kept at rest, and the lightest diet administered. Any other course is most unsafe.

The author next reports several cases showing that well-established cardiac lesions having lasted several years, and due to inflammation of the valves, may in later years entirely disappear. This may be observed in the case of the mitral bruit often heard in chorea, and dependent on organic changes. These murmurs of chorea, in fact, usually disappear eight or nine years after the attack. The same disappearance of all evidence of disease can often be observed years after a rheumatic endocarditis had produced a loud systolic murmur. Although such recoveries are often seen in the young, yet they sometimes take place in the old, and the author quotes cases in substantiation of this fact. Even well-marked valvular defects of a degenerative nature may in rare cases disappear. There must be *differentiæ* between the histories, habits, surroundings, occupations, etc., of those who suffer and die of heart disease, and of those who are not in the least incommoded by its presence.

According to Clark, the factors necessary in mitral disease for the exemption from unpleasant cardiac symptoms, and for the continuance in the duties and enjoyments of life, are as follows: 1, good general health; 2, just habits of living; 3, no exceptional liability to rheumatic or catarrhal affections; 4, origin of the valvular lesion independently of degeneration; 5, existence of the valvular lesion without change for over three years; 6, sound ventricles with moderate frequency and general regularity of action; 7, sound arteries, with a normal amount of blood and tension in the smaller vessels; 8, free course of blood through the cervical veins; 9, freedom from pulmonary, hepatic, and renal congestion. The prognosis in aortic disease is not so favorable even under the same conditions.

On the General Pathology of Heart Diseases.

We make the following extracts from the posthumous paper of Schott on this subject (*Zeitsch. f. klin Med.*, B. xii. H. 4, 295):

Insufficiency of the heart muscle. This may be *absolute* or *relative*. In *absolute* insufficiency there is no obstruction to the circulation, but an absolute diminution of muscle power. The heart muscle, like other muscles, is subject to atrophic changes from improper nutrition, lack of bodily and mental exercise, accumulation of fat, etc. "Fatty heart" can be cured without any loss of weight; but the usual treatment of obesity may act very injuriously on the heart by affecting the general nutrition. In very fat persons of great bodily and mental energy the heart retains its strength, as do other muscles. In purely *relative* insufficiency there is some obstruction to the circulation, but the heart muscle preserves its normal power. In reality, however, relative insufficiency is almost always combined with some loss of muscular strength. Complete compensation may exist or become developed.

Dilatation. Of this he makes two classes:

1. Dilatation which necessarily accompanies certain valvular lesions This, with muscular hypertrophy, forms an essential factor of the compensation. It may be called "compensatory dilatation." It is exemplified in the left ventricle in aortic and mitral disease.

2. The second form is characteristic of diseases of the muscle substance and of insufficient compensation. It is only the expression of an engorgement of the heart with blood, and might be named "dilatation of engorgement." It is very well represented by dilatation of the right heart following valvular disease of the left side, and by that of the left heart due to renal disease. It is produced by an imperfect emptying of the ventricle during systole. Dilatations of this form disappear with the development of complete compensation. After a few minutes of proper gymnastic exercise, the percussion boundaries of the heart sometimes become lessened. On the other hand, various causes may visibly increase the dilatation, as shown by the cardiac dulness.

The cardiac murmurs. In numbers of cases murmurs which were judged to be organic disappeared after a time. This is a strong proof that there had been no anatomical lesion. The sudden appearance and disappearance of murmurs may very often be observed. A murmur may sometimes be made to vanish in a few minutes through the diminution of dilatation produced by light gymnastics. The transition from mitral murmur to a divided (gespaltene) tone, which is often detected, is a probable proof of an abnormal action of the papillary muscle and of the absence of a valvular lesion. The author admits, however, that a recent mitral insufficiency due to endocarditis may, in rare cases, really heal. There exists an aortic insufficiency from dilatation of the aorta through high arterial tension. This murmur may disappear; but the author doubts whether true aortic insufficiency ever is curable.

Peripheral passive congestion and hydrops. Diminution of the amount of urine is a necessary result of heart disease, but need not be attended by dropsy. But when, through thirst, an increased quantity of fluid is brought into the system, hydrops appears. This increased thirst is induced by the retention in the blood of the solid elements of the urine. In other instances growing weakness of the right ventricle produces a like result. In all cases the progress of the circulatory disturbance is aided by the passive hyperæmia of the kidneys; and although the heart may grow stronger through treatment, the kidneys remain affected, and we find a clinical picture closely resembling that of contracted kidney. Great and painful increase in the size of the liver due to engorgement occurs early, even before any œdema or albuminuria appears;

but may be strikingly diminished by suitable gymnastics. The congestion of the lungs, liver, stomach, etc., is often much relieved by the development of œdema of the subcutaneous connective tissue. When the condition of engorgement becomes extreme, an element of inflammation is added. The pulmonary hyperæmia becomes splenization, the hydrothorax exhibits friction sounds, and erysipelas is very apt to appear.

New Investigations on the Gallop Rhythm.

Cuffer and Barbillion publish a long article in the February and March numbers of the *Archives Générales de Médecine*, 1887, in which they describe the gallop rhythm as made up of two normal heart sounds, to which is added a third abnormal one separated from them by an interval longer than in the case of a simple reduplicated beat. They draw the following conclusions:

1. A more complete classification of the varieties of gallop rhythm can be made than that at present adopted.

2. Gallop rhythms are *diastolic* or *mesosystolic,* according to the place which the abnormal bruit occupies in the cardiac cycle. In the first it immediately precedes, and in the second it immediately follows the cardiac impulse.

3. The diastolic gallop may itself be subdivided, according to whether it is produced in the *left* or the *right* heart.

4. The left diastolic gallop may be *permanent* or *transitory;* having in each case a different pathogenesis.

5. The permanent left diastolic gallop is due to a hypertrophy of the left ventricle, itself a result of a reflex influence from disease of the kidney; or of a permanent increase of arterial tension caused by a chronic nephritis or general arterio-sclerosis.

6. The additional beat is presystolic. It is a bruit of diastolic tension, caused by the blood forcibly entering, during systole, a rigid and unyielding left ventricle.

7. If the superadded sound is heard very close before the first normal sound, it is an evidence of concentric hypertrophy without dilatation. When it is separated by a longer interval, and tends to approach the second sound of the preceding cycle, it is an indication of dilatation, and the prognosis is more unfavorable.

8. Transitory left diastolic gallop is observed in acute affections of the kidneys, or in exacerbations of chronic affections. There is a spasmodic state of the cardio-arterial system, with a resulting transitory high tension.

9. Right diastolic gallop is produced by a reflex action from some gastric, hepatic, or intestinal disorder, exciting a spasm of the arterioles of the lungs, with an increased tension in the right heart. This increased tension causes the abnormal bruit in a manner analogous to its production in the left heart.

10. The mesosystolic gallop rhythm is characterized by an additional sound occupying the shorter silence.

11. There exist all grades of this, between the simple prolongation of the first sound and the most clearly marked reduplication.

12. It is the index of insufficiency of the cardiac systole which is sometimes slow and languid, sometimes acting twice to enable the ventricle to expel the blood which it contains.

13. The writers have met this variety of gallop rhythm in several cases of typhoid fever, in one of tuberculosis, and in one of mechanical interference with the heart. It might be met with wherever the heart is failing from any cause.

Finally, they reiterate that the diastolic gallop is a bruit of cardiac *strength* with *high* arterial tension, and the mesosystolic an *asthenic* bruit with *feeble* tension.

MORPHINE IN DIABETES.

T. MITCHELL BRUCE (*Practitioner*, 1887, 20) was induced by his success with morphia in the treatment of a series of cases of diabetes, to study from a therapeutic standpoint some of the still unsolved questions concerning the pathology of the disease. By administering morphia *per orem* to a selected case, and thus reaching the liver through the portal circulation, the glycosuria was made to disappear. When as large doses of the drug as the patient could bear were given hypodermatically, almost no effect on the elimination of sugar was obtained. The author concludes that, in the case in question,

1st. The glycosuria was due to an increased ingress of sugar into the blood; not to a diminished destruction of it in the system, else the hypodermatic use of morphia would not have been without effect.

2d. The increased ingress of sugar was not caused by a simple transportation of sugar from the intestine or portal vein to the general circulation, inasmuch as it continued unabated when an exclusively animal diet was employed.

3d. The excessive glycosuria going on in this case was effected mainly, or entirely, in the liver; not in the muscles or the other viscera. For (*a*) when the morphia was introduced into the liver by the portal vein it reduced the sugar to *nil*, but had little effect on the other viscera, while (*b*) when introduced into the general circulation hypodermatically, it diminished the amount of sugar but little, but had a decided effect on the other viscera, especially the central nervous system.

4th. In this instance if the diabetes was of nervous origin, the seat of the process appears to have been at any rate in the liver, not in the central nervous system.

THE OCCURRENCE OF ALBUMINURIA IN DIABETES.

Incited by the statement of Stokvis, that albuminuria is a very common complication of diabetes, POLLATSCHEK (*Zeitsch. f. klin. Med.*, B. xii. H. 1, 379) undertook some investigations on the subject. He found that of 2877 persons whose urine was examined in one of the chemical laboratories in Carlsbad, 1187 had glycosuria, and 437 of these latter had albuminuria also. Or, in other words, 37 per cent. of the cases of diabetes had albumen in the urine. He found, too, that albumen occurred oftener in urine that contained over 0.5 per cent. of sugar.

ON THE "STARCH-CONVERTING" FERMENT IN HUMAN URINE.

BREUSING publishes in *Virchow's Archiv*, B. cvii. H. 1, 186, his experiments relating to the statement of Holovtschiner made in April, 1886, that there existed in urine a ferment capable of transforming starch into dextrine and sugar.

He mixed equal portions of urine and of a one per cent. starch solution, and subjected them to a temperature of 37.5° C. for twenty-four hours or less. Although he found at the end of this time that the starch had completely disappeared, he was in no instance able to detect sugar by any test employed. In Trommer's test the suboxide of copper was, it is true, precipitated *after* boiling for some time, but the author properly considers this no proof of the presence of glucose. Although the experiment was modified in various ways, and the urine, both of healthy persons and of those suffering from various diseases, was utilized, the result was always the same.

It was interesting to observe that the starch-converting agent was present in the urine of diabetic patients. It was also detected in the fluid aspirated from a case of ascites.

Breusing is of the opinion that the ferment converts the starch only into one of the substances produced before the final change into glucose takes place.

ON THE CORRELATION OF THE SECRETA AND EXCRETA OF THE ORGANISM.

At the suggestion of Professor Riegel, STICKER and HÜBNER (*Zeitsch. f. klin. Med.*, B. xii. H. 1 and 2, 114) have attempted to discover whether the absence of free hydrochloric acid in the gastric contents in cases of carcinoma of the stomach, could be explained in any way by testing the degree of acidity of the urine at different hours in the day. After a series of extended researches they reach the following conclusions:

1. The reaction of the urine is subject to physiological variations, which show a constant dependence on certain processes going on in the organism.

2. The most important of these, in this connection, is the secretion of the digestive juices, especially those of the stomach and pancreas. Muscular action, and perhaps menstruation and psychical action, is of less importance.

3. If the various processes referred to are not going on, the urine preserves during this time and without variation the usual mean of the acidity of the twenty-four hours.

4. The absolute acidity of the urine passed during the twenty-four hours is constant for each individual under an approximately uniform state of the nutrition. It varies for different individuals, both in physiological and pathological conditions.

5. The acidity of the urine is chiefly or entirely dependent on the formation of free hydrochloric acid in the organism, and its retention there. If it is artificially or accidentally (as by vomiting, etc.) removed, the urine suffers as regards its absolute acidity.

6. The graphic curve, showing the variations of the acidity of the urine at different hours in the day, is in consequence of the predominating influence of hydrochloric acid in the reaction of the urine, in a certain sense the expression of the intensity of the digestive power of the stomach.

7. This curve has, however, no semeiotic value in pathological conditions since other processes in the organism, especially the secretion of the pancreatic juice, may disturb or destroy its typical appearance.

On Digestive Ferments in Normal and Pathological Urines.

Following the investigations of Holvotschiner, who found, both in normal and pathological urine, an amylolytic ferment having the power of converting starch in solution into both dextrin and sugar, Breusing (*Virchow's Archiv*, vol. 107, p. 186) made a series of experiments, using more exact methods than the first observer for the detection of the sugar.

He found that on mixing varying quantities of a one per cent. solution of boiled starch with urine and keeping the mixture for twenty-four hours at a temperature of 37.5° C., no starch was to be found with the iodine test at the end of that time. Iodine gave a brown, yellowish, or rose color when added to the solution. With Moore's test—the only one Holvotschiner had used—a distinct brown coloration appeared, but on more careful examination it was found that this did not arise from the presence of sugar. Trommer's test was reduced only after *boiling* for two to four minutes (glucose reduces it at once and before the boiling-point is reached), and the fermentation test—the most conclusive of all we have for sugar—gave absolutely negative results. No difference could be observed in the action of pathological or normal, or of night or day, urines. To prove that the amylolytic action is really due to the presence of a ferment, Breusing separated the ferment by precipitation with an excess of absolute alcohol, in the usual way, and found that it acted, when alone, upon solutions of starch the same as it did when in the urine. Boiling the urine destroyed its action.

He presumed that in diabetes this ferment might possibly be absent on account of its having been consumed in the body in the conversion of starches to glucose. But the examination of a specimen of diabetic urine, containing 5.8 per cent. of glucose, showed it to act even more powerfully and rapidly than normal urine, indicating the probable presence of a large quantity of this ferment.

[These experiments show that urine contains an amylolytic ferment capable of converting boiled urine into some of the preliminary stages of glucose, namely, the various dextrines known as erythro- and achroo-dextrines, whose presence was denoted by the various colors of rose and yellow and brown assumed by the solution on the addition of iodine, but that the conversion is not carried to the final product—*i. e.*, glucose.]

It is interesting to note, in this connection, that Mya and Belfanti (*Centralblatt f. klin. Med.*, 1886, No. 42) found that in 28 cases of Bright's disease (4 acute, 24 chronic), the trypsin normally found in urine was invariably absent, while pepsin was nearly always present. In febrile and physiological albuminuria, on the other hand, the trypsin was never absent. This difference might, in doubtful cases, serve as a means of differential diagnosis. The method of determination employed consisted in soaking 2 grammes of fibrin in 500 c. c. of urine for three hours, then pressing out the excess of urine and transferring the fibrin to a 1 : 5 per cent. solution of borax, and keeping it thus at a temperature of 37.5° C. for twenty-four hours. The borax solution prevents putrefaction. One-half of the fibrin was used to determine the trypsin and one-half for the pepsin. After a twenty-four hours' digestion, the amount of fibrin remaining after washing and drying determined the amount digested.

REDUCING SUBSTANCES, OTHER THAN GLUCOSE, IN DIABETIC URINE.

Struck with the discrepancies in the quantitative results obtained by subjecting the same specimen of diabetic urine to the fermentation, the copper-oxide reduction, and polariscopic tests, respectively, LEO (*Virchow's Archiv*, vol. 107, p. 99) endeavored to discover the source of these errors. He succeeded, after removing all the ordinary reducing substances, as uric acid, creatinin, coloring matters, etc., in finding a new substance belonging to the sugar series, and with the power of strongly reducing the copper-oxide solutions, whether as Fehling's or Trommer's tests. This new substance, for which no name has as yet been proposed, is isomeric with glucose. It turns the polarized ray to the *left* —26.73°, and hence, when present, makes the polariscopic readings for diabetic urine indicate a lower percentage of glucose than is actually present. It reduces copper-oxide solutions; 10 c. c. of Fehling's solution corresponding to 0.1242 grain, or one molecule, corresponding to 2.012 molecules of sugar. In using this test, therefore, larger quantities of glucose than are actually present will apparently be obtained. It is not fermentable, and this property distinguishes it from all other sugar-like bodies found in the urine, and at the same time proves the value of fermentation as a test for glucose, for, besides glucose, only levulose, whose occurrence is very rare, is fermentable.

This substance was found in 3 out of 21 cases of diabetes. It did not occur in a large number of normal urines examined.

SERUM-ALBUMIN IN NORMAL URINE.

POSNER (*Virchow's Archiv*, vol. 104, p. 1) has made careful investigations to settle this much-disputed point, with the result of showing that a minimal amount of serum-albumin is a constant constituent of normal urine. This is important in view of the significance which is attributed by many to the detection of almost infinitesimal quantities of albumin by such delicate reagents as the potassio-mercuric iodide, picric acid, etc. When we consider the constant presence in the urine of albuminoid anatomical elements, it is not surprising that their disintegration and solution should liberate an amount of albumin which, though small, is still appreciable.

SURGERY.

IN EUROPE.

UNDER THE CHARGE OF

FREDERICK TREVES, F.R.C.S.,

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RECENT SURGICAL LITERATURE.

The last new volume of the *Dictionnaire Encyclopédique des Sciences Médicales* runs from "Uri" to "Ute." The article on the urinary passages is completed. Under the heading of "The General Pathology of the Urinary Passages," M.

ROCHARD discusses retention, incontinence, and extravasation of urine, and urinary abscess. The matter is a little spun out. The paper that follows—"A Monograph on Urinary Fistulæ," by M. MONOD, is the best in the volume. He deals with fistulæ of the kidney, ureter, bladder, and urethra, and with fistulæ in women. The article is very complete and is a masterpiece of elaborate work. A very short paper on calculi, by M. DERBOULLET, deals merely with the general chemical characters of urinary stones. The rest of the volume is taken up with the article "Urines" and the commencement of the series of papers on the uterus.

Die Allgemeine Chirurgische Pathologie und Therapie, by DRS. BILLROTH and WINIWARTER (Berlin, 1887). This is a new edition (the thirteenth) of Billroth's well known work on general surgical pathology and treatment. The book has been revised by Dr. Winiwarter and brought up to date. It still remains the best text-book on surgical pathology.

Études Experimentales et Cliniques sur la Tuberculose, edited by M. VERNEUIL (Paris, 1887). This is the first fasciculus of a work on tuberculosis and is the outcome of an organized effort to solve the mystery of this affection. It contains papers by a great many authors, and the whole volume is filled with original matter of the greatest value. The papers of the greatest surgical interest are the following: LANNELONGUE, on "External Congenital Tuberculosis;" RECLUS, on "Primitive Tuberculosis of the Scrotum;" VALUDE, on "Ocular Tuberculosis;" DEMARR and VERNEUIL, on "The Generalization of Tuberculoses after the Ablation of a Primary Tubercular Disease;" VERCHERE, on "The Treatment of Scrofulous Neck."

Die Typischen Operationen, by DR. EMIL ROTTER (Munich, 1887). This is a very compact little work on the chief operations in surgery. It is very ingeniously arranged and is intended in reality to be a handbook.

The chief points of each operation are given clearly and the descriptions are brief but good. The anatomy of each operation is given in detail, and excellent diagrams of the stumps of several amputations are given so as to show the position of the bleeding points.

Anleitung zur Wundbehandlung, by DR. SCHAECHTER (Wiesbaden, 1887). This large work forms a complete treatise upon the treatment of wounds and is a production of conspicuous merit. The author deals in the first place with the pathology of wound-healing and thus introduces the inevitable bacillus. Then follow chapters on sepsis and the complications of wound-healing. The main part of the volume is occupied by the treatment of wounds in general and of wounds of special parts. The list of materials for dressing described under the heading of general treatment is remarkable and alarming.

Tumeurs de l'Ombilic, by DR. VILLAR (Paris, 1887). This is a work peculiar to French industry, a substantial volume on tumors of the umbilicus (excluding hernia). The following is the classification adopted by the author:

Benign. Vascular: angioma, lymphocele. Granuloma: the fungus of the newly born. Adenoma: intestinal, gastric. Cysts: sebaceous, dermoid. Fibro-papilloma. Myxoma.

Malignant. Sarcoma, epithelioma, carcinoma.

Nearly ninety illustrations are given. There is an exhaustive bibliography The illustrations are very poor.

Die Allgemeine Pathologie oder die Lehre von den Ursachen und den Wesen der Krankheitsprocessen, by DR. EDWIN KLEBS (Jena, 1887). This is the first volume of an ambitious work (on general pathology or the science of the causes and action of disease-processes). The volume is disappointing because nearly the whole of it is occupied with descriptions of bacteria. The author deals—in the 500 pages of this volume—with such diseases as are conspicuously associated with microörganisms. The work is admirably done and the illustrations are excellent.

Das Venerische Geschwür, Vorlesungen über dessen Pathologie und Therapie, by DR. E. LANG (Wiesbaden, 1887). This admirable work on the pathology and treatment of venereal ulcers comes from the pen of a well-known author. The subject is exhaustively dealt with and the chapters on exceptional venereal sores and on differential diagnosis are especially valuable. The author's conclusions are founded upon ample clinical material and a wide experience.

Uber die Excision der Syphilitischen Initialsklerose, by DR. J. BÖHN (Breslau, 1886). This dissertation discusses the question of the value of excision of the primary sore in syphilis. The author is of opinion that the measure may entirely prevent the development of constitutional syphilis. He allows that the treatment is not always successful, and is unable to give the data upon which the chances of failure may be estimated. The work is of special value as giving a full bibliography of the whole of this vexed question.

Die Epistaxis und ihre Behandlung, by DR. BAUMGARTEN (Vienna, 1886). This is an elaborate treatise upon the pathology and treatment of epistaxis. The account of the anatomy of the nasal mucous membrane is very full. The etiology of epistaxis is fully dealt with, as is also the question of treatment. In the latter direction it cannot be said that any very new matter is introduced.

Dell' Artrectomia Pargiale e Totale, by D. E. PAOLI (Turin, 1887). A full account is provided of the operation of arthrectomy. Details are given with regard to each individual point. The more practical part of the work is founded upon an account of 20 cases. Among this number were 14 cases of strumous joint disease. 13 of these ended in cure, with useful limbs, and 1 died of general tuberculosis. The author regards total synovial arthrectomy as an excellent means of promoting fibrous ankylosis. He applied it with success in a case of chronic synovitis with loose bodies in the joint and undue mobility of the limb.

Transactions of the Academy of Medicine in Ireland, Vol. IV. (Dublin, 1887). In addition to certain surgical papers that have been already noticed, the present volume contains the following contributions: "The Advantages of the Principle of Dry Dressings in Antiseptic Surgery," by DR. BANKS; "The Surgery of the Suakim Expedition," by DR. TOBIN; "Electrolysis in the Treatment of Urethral Stricture," by MR. HAYES.

Die una speciale medicazione abortiva dell' erisipla, by Dr. Arnici (Rome, 1886). In this small but ambitious work the author claims to have discovered the abortive treatment of erysipelas. He makes use of an alcoholic solution (apparently 1 in 1) of carbolic acid. This is painted freely over the skin on and about the margin of the spreading erythema. The solution is applied, not only to the reddening edge, but also to the sound skin for a few centimetres beyond that edge. Two or three applications are made within a few hours. No local trouble is said to follow. The pain that arises is checked by the use of cold. He thinks the paint acts partly as a caustic, partly as an antiseptic. He has treated 12 cases of erysipelas by this means, and 2 examples of lymphangitis. In all an immediate and rapid cure followed.

Die Pathologie und Therapie der Gelenkentzündungen, by Prof. Max Schuller (Vienna, 1887). A short, but excellent and complete account of inflammatory affections of the joints. Prof. Schüller's valuable work upon scrofulous joint disease is well known. This monograph embraces the whole subject. It is well written, well arranged, and full of original matter. It is up to date, and concludes with an exhaustive bibliography.

St. Thomas's Hospital Reports, vol. xv. (London, 1887). The following are the chief surgical papers: "Three Cases of Nerve Suture," by Sir William MacCormac. In one case the ulnar nerve was united by suture six years after division. Restoration of nerve function followed. "Pre-prostatic Puncture of the Urethra," by Mr. Makins, a valuable paper, giving an analysis of 46 cases. "Neurectomy of the Second Division of the Fifth Nerve," by Mr. Clutton. The operation was performed for intractable neuralgia. "Nerve-stretching of the Inferior Dental Nerve for Neuralgia," by Mr. Bernard Pitts.

Westminster Hospital Reports, vol. ii. (London, 1887). The two surgical papers in this volume are the following: (1) "Solid Abdominal Tumors," by Mr. Cowell—an account of three interesting cases. Two were ovarian fibromata, and the third a fibroma of the round ligament. (2) "Rheumatic Osteitis," by Mr. Macnamara. An elaborate and valuable paper, with two illustrative cases.

Diseases of Bones and Joints, by Mr. Macnamara (third edition, London, 1887). In the present edition many chapters have been rewritten, much new matter and many excellent illustrations have been added, and the book is brought well up to date.

Bacteria and Tubercular Abscess.

Dr. Farré (*Deutsche med. Wochenschrift*, 1880, No. 84) has published an important paper on this subject. He has examined 30 cases of cold or tubercular abscess. In only a very few instances were bacilli found in the pus. In the cases in which no bacilli were detected cultivation experiments led to nothing. Small quantities of the pus that was free from bacilli were injected into animals with the usual precautions. In every case tuberculosis followed. Here, then, is an example of tuberculosis produced by inoculation with a material that contained no tubercle bacilli, and yielded none of the cultivation. The paper is largely occupied by the author's theories to meet this fact. Incidentally the following data are given for the separation microscopically of tubercular pus from simple inflammatory pus. In the latter the cells are long and well preserved; there is little or no débris, pyogenic cocci are present. In the former the cells are ill formed, many are wasted. There is much fatty débris, and no cocci.

THE USE OF IODOL.

DR. F. J. PICK (*Vierteljahrsschrift für Dermatologie und Syphilis*, 1886, p. 583) has used iodol in 93 cases with the following results. It is excellent in the treatment of catarrhal affections of the genitals, especially in women. It is also of considerable use in moist condylomata, but is of less value in the treatment of venereal ulcers. It has proved of but moderate value in the dressing of gummatous ulcers and buboes.

The drug has been given internally, but without any benefit. The author points out that when iodol is given internally the iodine reaction is obtained in the urine. No such reaction is observed after local application of the drug.

A NEW MICROCOCCUS.

PROFESSOR MANFREDI (*Fortschritte der Medicin*, Bd. iv. p. 713) claims to have added another coccus to the already bewildering list of microörganisms.

The author founds his discovery upon two fatal cases of croupous pneumonia. In the sputa in these cases he found, in addition to the usual pneumonic bacillus, another specific bacillus of extraordinary properties. It was of oval shape, and was easily cultivated upon gelatine. The cultivation area was at first a delicate blue, and then a pearl gray, with sinuous margins. The inoculation of dogs and rabbits led to a fatal issue in seven to twelve days. Before death there occurred an enormous swelling of the spleen, and great hypertrophy of the lymphatic glands. The tumors were composed of granulation-like tissue, and rapidly caseated. The lungs were the seat of pneumonia, and also of like granular masses.

The author terms the bacillus "The micrococcus of the progressive lymphoma," and considers it the cause of the neoplasms that developed in the animals' bodies.

THE INCUBATION STAGE OF HYDROPHOBIA.

DR. BAUER (*Centralblatt für Chirurgie*, January 1, 1887) deals with 537 examples of this disease in man, in which the period of incubation is stated. 10 cases are rejected as doubtful, and 17 in which it is asserted that the incubation stage extended beyond 15 months. In the remaining 510 cases the average incubation period is 72 days. So far as can be shown, the primary treatment of the wound has no effect upon the duration of this period. The following factors in influencing the length of the period between the time of the bite and the appearance of symptoms are evident.

Sex. In males the average period is 80 days; in females, 65 days.

Age has considerable influence, the stage being shortened by 20 days in patients under 14 years of age.

The Infecting Animal.

Bite from	wolf,	49 cases,	average	incubation	stage,	39	days.
" "	dog,	293 "	"	"	"	73	"
" "	fox,	2 "	"	"	"	33	"
" "	cat,	31 "	"	"	"	80	"
" "	cow,	1 case,	"	"	"	30	"

THE TREATMENT OF ERYSIPELAS.

DR. NUSSBAUM (*Allg. Wiener med. Zeitung,* 1887, No. 1) advises ichthyol for the treatment of erysipelas migrans. It is applied in the form of an ointment, composed of ichthyol and vaseline, in equal parts. This is applied over the spreading margin. The part is then covered with a 10 per cent. salicylate wadding. The measure has been tried in 5 cases, with uniformly good results.

CANCER OF THE BREAST.

MR. H. T. BUTLIN (*British Medical Journal,* 1887, vol. i. p. 436) gives the result of the investigation made upon this subject by the Collective Investigation Committee of the British Medical Association. The returns number 210.

1. *The influence of mastitis in the production of cancer.* Out of 174 instances previous inflammation or abscess of the affected breast had been noted in 27 cases. No such disturbance had been noted in the remaining 147 cases. From the returns it may be gathered that a previous mastitis plays a quite unimportant part in the etiology of cancer. In nearly one-half of the cases 20 years had elapsed between the inflammation and the appearance of the tumor. The form of inflammation that would seem to predispose to cancer is one that is continuous, or liable to frequent recurrence, or the seat of a chronic irritation.

2. *The influence of inheritance.* Out of 184 cases, in 116 there was no family history of cancer; in 68 there was. The manner of distribution in the 68 cases was as follows: 44 patients had only one cancerous relative, 19 had 2, 3 had 3, and 2 had 4 cancerous relatives apiece.

Thus the 68 patients had among them no less than 99 cancerous relatives.

In only 30 instances were the parents, grandparents, or great-grandparents of the patient cancerous.

There is thus a history of cancer in the direct line of descent in no less than 20.6 per cent. of the cases.

3. *The influence of diet.* Out of 194 returns 123 patients are stated to be moderate feeders, 57 small feeders, and 12 large feeders. The tables do not support the statement that cancer is more common in large eaters of meat.

4. *The influence of locality.* The returns under this heading, as well as under the previous one, are scant and unsatisfactory. Town, as compared with country, and high elevation, as compared with low, would appear to have no influence in the etiology of cancer.

The returns agree, to a great extent, with the conclusions of Mr. Haviland, who finds the lowest rates of mortality from cancer in those parts of Enlgland and Wales which are composed of the hardest and most elevated rocks, or the most absorbent (like the oölite and chalk); and the highest rates in the sheltered and low-lying grounds which are composed of crag, alluvium, and clay.

EXCISION OF THE KNEE.

MR. MORRANT BAKER (*British Medical Journal*, 1887, vol. i. p. 321) points out the difficulty of maintaining the bones in position after the operation, and proposes the following procedure, which he has carried out with success:

After the bone-ends have been resected the tibia and femur are fixed together by means of two strong steel pins. These are made to transfix the tibia and bury themselves in the femur. They are so introduced that they cross one another, St. Andrew's cross fashion. The tibial end of the pin is left projecting beyond the skin. The pins are removed as soon as they become loose. This may occur at the end of a few days, or not for a period of from four to seven weeks. The paper concludes with 14 illustrated cases.

MR. HOWARD MARSH (*Ibid.*, p. 389) favorably considers Mr. Baker's operation. Mr. Marsh recommends the splint described in Gant's *Practice of Surgery*, 2d edition, vol i. p. 16, and employs bone pins instead of those made of steel. Ordinary bone knitting needles are used. The holes in the tibia are bored by means of a bradawl, the ends of the knitting needle are sharpened, and when they have transfixed the tibia are driven into the femur by a few taps from a mallet. The pins are cut short, and are left permanently *in situ*. Mr. Marsh has used these bone pins combined with Mr. Gant's splint in nine cases.

INTERNAL DERANGEMENTS OF THE KNEE-JOINT.

PROFESSOR ANNANDALE (*British Medical Journal*, 1887, vol. i. p. 319) includes the following conditions under this term (excluding "loose cartilages"): 1. Displacements of the semilunar cartilage. 2. Growths in the interior of the joint. 3. Growths from the bone protruding into the joint.

1. One or other of the semilunar cartilages (most frequently the internal one) is liable to be displaced and to interfere with the joint movements. The displacement is, as a rule, slight. The anterior attachments of the cartilage are those which are most frequently separated. The displacement may take place suddenly, due to a twist or wrench, or may occur gradually from the excessive use of certain movements, especially kneeling. Displacement of the inner cartilage is usually produced when the leg is rotated outward, and of the outer cartilage when it is rotated inward. The operation the author adopts in this condition is the following: An incision is made over the cartilage in a horizontal direction, extending backward from the edge of the patellar ligament about three inches. The joint is opened. The cartilage is replaced and fixed in position by catgut sutures that take hold of the periosteum and fascia about the upper end of the tibia.

2. Three examples are given—two of lipomata and one of myeloid sarcoma. In the former a fatty growth from the synovial membrane over one of the semilunar cartilages was present. It was removed and perfect recovery followed. The sarcomatous growth was the size of a horse bean, and grew from the synovial membrane. It was successfully removed. In these three cases

symptoms were present that closely resembled those due to displaced semilunar cartilage.

3. In this case—a solitary example—a bony growth, due to chronic rheumatic arthritis, grew from the lower end of the femur. It caused much impairment of the movements of the joint. It was removed and a successful result followed.

AMPUTATION IN DIABETIC GANGRENE.

PROFESSOR KÖNIG (*Centralblatt für Chirurgie*, No. 13, 1887) has contributed an interesting paper on this subject. He points out that diabetic patients are liable to a low form of inflammation; that their tissues present a favorable nidus for the development of microörganisms, and show a ready disposition to necrose. He suggests that in all cases of apparently spontaneous gangrene, or of gangrene from trifling causes, the urine should be examined for sugar.

In inflammatory affections, in necrosis, and in gangrene occurring in diabetic subjects, the first and most persistent treatment should be by the use of antidiabetic measures. Amputation should not be entertained until the diabetic symptoms are retrograde. If in spite of treatment and careful local antiseptic measures, the local and general symptoms do not improve, then operation must be undertaken as a possible means of saving the patient's life.

REDUCTION OF SHOULDER DISLOCATIONS.

DR. MACLEOD (*British Medical Journal*, 1887, vol. i. p. 507) claims for the method of reduction he describes the following advantages. It is easy, rapid, painless, needs no anæsthetic, apparatus, or assistants, and probably does no injury to the joint.

The method may be described as lateral extension in the supine position.

Place the patient on his back on the floor with the arm at right angles to the body, and tell him to lie still and make no effort. The surgeon, sitting on the floor at right angles to the patient's body, places his heel in the axilla, quietly takes the limb by the wrist and upper arm, and pulls in a line at right angles to the line of the trunk, at first gently and then gradually increasing up to a force of a few pounds—the arm being still on the floor, or but slightly raised from it. As reduction may take place without any intimation, to ascertain if this has occurred the hand may be placed on the joint, or the limb adducted. If necessary, repeat the traction with a greater degree of force, and should all the force that can be applied short of giving pain, fail, gentle rotation of the limb, first in one direction and then in the other, can also be made with traction. The supine position is the only one in which the muscles are completely relaxed. The abducted position removes all strain from the deltoid, and the limb is placed in the same posture, probably, that it occupied at the time of the accident.

SUBLUXATION OF THE LOWER JAW TREATED BY OPERATION.

PROFESSOR ANNANDALE (*Lancet*, 1887, vol. i. p. 411) points out that this condition is due to displacement of the interarticular cartilage. Such displacement is most common in delicate women, and is due either to inflammatory changes of a simple, gouty, or rheumatic nature, or to a sudden tearing or gradual stretching of the connections of the cartilage.

The author proposes to relieve the condition by an operation similar to that which he has described for the relief of displaced semilunar cartilage of the knee-joint. An incision slightly curved, about three-quarters of an inch in length, is made over the posterior margin of the external lateral ligament of the joint, and is carried down to the capsule. Any small bleeding vessels having been secured, the capsule is divided and the interarticular cartilage is seized, drawn into position, and secured to the periosteum and other tissues at the outer margin of the articulation by a catgut suture. Two illustrated cases are given in women aged respectively thirty-eight and eighteen. In both the condition was perfectly relieved.

THE SURGICAL TREATMENT OF PULMONARY CAVITIES.

MR. RICKMAN GODLEE (*Lancet*, March 5, 1887, *et seq*) has published two important lectures on this subject. The paper opens with an account of the history of this branch of surgery. Mr. Godlee traces the surgical treatment of pulmonary cavities back to the time of Sir Edward Barry, in 1726.

The following are the conditions in which surgical interference may be or has been attempted: 1. Tubercular cavities. 2. Cavities resulting from gangrene of the lung. 3. Cavities resulting from the bursting into the lung of abscesses or other collections of irritating matter from without. 4, Bronchiectasis, from whatever cause arising, and including those which depend upon the presence of a foreign body in the air passages.

Gangrenous cavities resulting from some form of pneumonia are the most promising to deal with.

The author lays stress upon the difficulty of dealing with a non-adherent pleura. "The right method of procedure in such a case, though I confess it is not a very easy one, is carefully to stitch the lung up to the opening which has been made in the chest walls."

The first lecture concludes with a series of illustrative cases from various sources and from the author's own practice.

The second lecture gives a most valuable account of the anatomy of the bronchi, illustrated by excellent diagrams. The author follows in the main Abby's account of the parts. The position of the principal bronchi with reference to the thoracic wall is given in detail.

The practical outcome of the anatomical facts is expressed as follows: 1. Foreign bodies of any considerable size will probably lodge somewhere in the main right bronchus at a distance not greater than three inches from the middle line. 2. As regards bronchiectases the smaller peripheral bronchi often serve as the starting-points for excavations of considerable size. 3. Arteries follow with great regularity the posterior surface of the bronchi. They are of considerable size, and would almost certainly be divided in any attempt to open a main bronchus from behind.

With regard to the treatment of bronchiectases, the author writes: "Our main objects in attempting to open a bronchiectatic cavity are: (1) That the secretion from it may be prevented from continuing the mischief in its passage over the bronchi, or as it is drawn down into other parts of the lungs; (2) that the cough may be diminished, it being held that the expiratory efforts have something to do with the production of the dilatation; and (3) because it is well known that, though patients with this disorder may go on for a number of years without succumbing to it, a very large number become comparatively soon affected with some form or other of blood poisoning. With these objects in view, I should feel disposed to recommend an operation if the physician were to express a strong opinion that the cavity was a single one, or at least that the mischief was principally caused by one main cavity, and also in those cases where it has arisen from the irritating presence of a foreign body in one of the bronchi. In the latter case it would be done in the hope of removing the foreign body; in the former, in the fear that, notwithstanding the diagnosis of a single cavity, there would be found others in the same lung, and not improbably in the other lung, which, it may be, was supposed to be sound."

Illustrative cases of the surgical treatment of bronchiectases are given.

CONTUSION-PNEUMONIA.

DR. A. KOCH (*Dissertation-Munich und Centralblatt für Chirurgie*, No. 10, 1887) gives what little is to be given of the history of this disease, and adds the following case: A man, aged thirty-eight, fell from a great height and received a severe contusion of the left thorax. He however continued with his work after the accident and also on the second day. Toward the end of the second day he began to feel ill and experienced a severe pain in the chest. He went to the hospital, where he died three hours after admission. The post-mortem showed croupous pneumonia with red hepatization. The lung swarmed with the bacilli of pneumonia. The ribs were not injured. The patient was entirely free from disease at the time of the accident.

THE SURGICAL TREATMENT OF EMPYEMA.

DR. KASANLI (*Vratch*, 1866, Nos. 13 to 18) deals with this subject in a very exhaustive manner. The paper commences with an account of the history of the operation. 21 cases of empyema are dealt with. The subjects were young soldiers under care in a military hospital. Of the 21 patients, 10 died; 5 of tuberculosis, 1 of tetanus, 1 of pericarditis, 1 of pyæmia, and 2 of exhaustion. Of those who recovered, 8 are reported as being perfectly cured and 3 as recovering with a persisting sinus. The operation was the same in all cases, and was as follows. A rib is not removed. The fluid—especially when of large amount—is removed very gradually day by day through an aspirator. When the thorax is nearly empty an incision is made under antiseptic precautions, and a drain introduced which is carried into a vessel containing a solution of corrosive sublimate. A clamp is applied to the tube so as to allow of the slow discharge of the pus. In twenty-four hours the wound is enlarged still more, free drainage with a large open tube carried out for the first time. The tube is removed on an average on the thirty-fourth day. Recovery may be expected by the forty-fourth day.

THE SURGICAL TREATMENT OF AFFECTIONS OF THE PLEURA AND LUNGS.

DR. ROCHELT (*Wiener med. Presse*, 1886, No. 32) comes to these conclusions: In acute pleuritic effusions the fluid should be removed at once by aspiration. In cases of chronic effusion the fluid should be withdrawn gradually by repeated tappings.

Empyema should be treated by free incisions. He gives an account of two cases of pneumothorax in phthisis treated by operation. One recovered, one died. An excellent case of bronchiectasis is reported that was cured by pneumotomy. The patient was fifty-four and the subject of chronic bronchitis. Portions of ribs were removed and the lung cavity opened and drained. Two cases of lung abscess were treated by incision. Both died; while one case of gangrene, treated by the same measure, ended in recovery.

Dr. Ribbing (*Eira*, 1886, No. 16, Sweden) deals with sixteen cases of empyema, all treated by operation. Strict antisepsis was employed and free drainage. In no case did death result. In children the author considers that simple incision is sufficient. In adults, when relapse occurred, portions of ribs were resected. Washing out of the cavity is not ordered unless the pus be putrid. In all cases the evacuation of the matter should be slow.

The Diagnosis of Stricture of the Œsophagus.

Professor Ogston (*Medical Chronicle*, January, 1887, p. 278) points out the difficulties in the diagnosis. There may be dysphagia—depending upon dyspepsia, bronchitis, or post-diphtheritic paralysis—and yet no stricture. Stricture at the lower end of the gullet is most common in patients past middle life, and is due to cancer. In such cases the author lays stress upon the painful distention of the gullet after swallowing, felt in the centre of the thorax and the accompanying breathlessness and sense of distress.

Strictures in the upper part of the œsophagus usually occur in younger subjects, and depend upon cicatrix, diphtheria, or syphilis. In such cases the pharyngeal distention on swallowing can be made out on the left side of the neck.

In making a diagnosis Professor Ogston lays great stress upon the time occupied by the act of swallowing. In healthy subjects the passage of the food along the gullet occupies from two and a half to eight seconds. In cases of stricture it occupies from fourteen to eighteen seconds.

The starting of the bolus is indicated by the movement of the pomum Adami. "If the ear be placed behind the left thorax, three inches below the angle of the scapula, the moment of entrance into the stomach can nearly always be told by a distinct amphoric gurgle or amphoric rushing sound. By noting these two points the time involved in the act of swallowing is indicated."

Lipoma of the Mesentery.

M. Terillon (*Bull. et Mém. de la Soc. de Chir.*, t. xii. p. 23) reports the case of a man aged thirty-five, upon whom laparotomy was performed for the removal of a large lipoma. The mass had grown between the layers of the mesentery, and weighed fifty-seven pounds. The patient died of enteritis (followed by peritonitis) on the thirty-second day after the operation.

M. Terillon gives details of 14 other cases of lipoma of the mesentery. 7 were discovered on post-mortem examination, and 7 were removed by operation. Of the latter, only 2 recovered. Death was in each case due to either shock or peritonitis. Mesenteric lipomata occur in adults, and always grow between the layers of the mesentery. The intestines lie in front of them, or to one side. Ascites is rare, and adhesions are occasionally met with. A correct diagnosis is not usually made, the affection being mistaken for cystic tumors in most instances. Pathologically, the growths belong to the myxolipomata.

THE ETIOLOGY OF PERITONITIS.

DR. GRAWITZ (*Charité-Annalen*, XI. Jarhgang, p. 779) has published a very valuable paper upon this subject. It is founded upon an extensive series of experiments made upon the lower animals.

Into the elaborate details of the research it is impossible to enter. The more important conclusions are these: Schizomycetes or Staphylococcus aureus injected into the peritoneal cavity will not of themselves produce peritonitis if the injecting medium be non-irritating. In the production of suppurative peritonitis two conditions are necessary in the majority of cases: 1. The introduction of pus-producing microörganisms; and, 2. The existence of some local disturbance. The latter condition is afforded when the intestinal tube is gorged with much stagnant matter and when the serous membrane has been denuded of its epithelial covering.

The subject of peritonitis from cold is discussed, and Dr. Grawitz concludes that cold alone cannot become a cause of peritonitis, nor does he consider it an important local factor when the other possible causes of peritonitis are present.

The paper concludes with a consideration of the peritonitis that often attends stenosis of the bowel and strangulated hernia. In both circumstances local damage to the serous membrane plays a very conspicuous part.

THE TREATMENT OF HEMORRHOIDS BY EXCISION.

MR. WHITEHEAD (*British Medical Journal*, vol. i. p. 449, 1887) gives an account of no less than 300 consecutive cases treated by means of the operation that now goes by his name.

The treatment by ligature is very unsatisfactory and a relapse is quite common. The treatment by the clamp and cautery is still more unsatisfactory. Its immediate risks are greater and its failures by recurrence more numerous.

The present operation has been performed upon over 300 patients without a death, a single instance of secondary hemorrhage, or one case where any complication such as ulceration, abscess, stricture, or incontinence of feces, has occurred.

The following are the details of the operation: The patient is anæsthetized and placed in the lithotomy position. The sphincters are well paralyzed by stretching. By the use of screws and dissecting forceps the mucous membrane is divided at its junction with the skin round the entire circumference of the bowel, every irregularity of the skin being carefully followed. The external and the commencement of the internal sphincters are then exposed by a rapid dissection, and the mucous membrane and attached hemorrhoids, thus separated from the submucous bed on which they rested, are pulled bodily down, any undivided points of resistance being snipped across and the piles brought below the margin of the skin. The mucous membrane above the piles is now divided transversely in successive stages, and the free margin of the severed membrane alone is attached, as soon as divided, to the free edge of the skin below by sutures. Bleeding vessels are secured by twisting. A complete ring of pile-bearing mucous membrane is thus removed. No skilled assistance is required. The wound is dressed with iodoform. The sutures are of carbolized silk and are not removed. Castor-oil is given on the morning of the fourth day. The patient can resume work within a fortnight. The amount of pain after the operation is trifling, and retention of urine is uncommon.

HERNIA OF THE CÆCUM.

MR. FREDERICK TREVES (*British Medical Journal*, 1887, vol. i. p. 382) commences a monograph upon this subject by an account of the history of the hernia as displayed in surgical literature. In one of the earlier recorded cases (1732) the cæcum was exposed and entirely excised, the patient making a good recovery. Mr. Treves draws attention to the fact that the text-books describe the cæcal hernia as being without a sac. An account is given of the various reported cases upon which this statement is founded, and it is shown that in the more conspicuous instances the evidence is unsatisfactory.

Two cases are given. The first was met with in a man aged forty-one. The rupture was inguinal, the sac was double, and of enormous size. The sac was cut away, the cæcum exposed and reduced. A complete cure resulted.

The second case was in a woman aged fifty-six, and occupied the femoral region. The appendix could be distinctly felt. The hernia was reducible.

The author proceeds to examine 15 recent cases (8 from recent records, 9 from metropolitan museums). It appears that the hernia is much more common in the inguinal than the femoral region, and is more common in males than in females. There is, in nearly every instance, a perfect sac. In a few examples it was incomplete; in no case was it absent. The caput coli may be protruded alone, or in the hernia coils of ileum and omentum may be found. The rupture tends soon to become irreducible.

MR. G. A. WRIGHT (*Ibid.*, p. 507) gives an account of seven cases of cæcal hernia in children. The patients were between the ages of three months and seven years. They were all males, and the rupture in each instance inguinal. In all the cases operated upon there was a perfect and well-defined sac. The sac may be funicular, or be formed from the open tunica vaginalis.

The paper serves to modify Mr. Treves's statement that "the hernia of the cæcum is practically limited to adults."

PAROTITIS IN ASSOCIATION WITH ABDOMINAL DISEASE.

MR. STEPHEN PAGET (*British Medical Journal*, March 19, 1887) has, with great diligence, collected no less than 101 cases of parotitis consequent upon injury or disease of the abdomen or pelvis; of this number, 10 were due to injury or disease of the urinary tract; 18 were due to injury or disease of the alimentary canal, and 23 were due to injury or disease of the abdominal, the peritoneum, or the pelvic cellular tissue. The remaining 50 were due to injury or disease, or temporary derangement of the generative organs. Under the latter term are included slight blows on the testis, the introduction of a pessary, menstruation, and pregnancy.

This form of parotitis appears to be non-pyæmic, to have no definite incubation stage, and to end very often in suppuration. Mr. Paget considers that the sequence of disease is due to influences acting through the nervous system.

THE TREATMENT OF ECTOPION VESICÆ.

DR. ZESAS (*Centralblatt für Chirurgie*, No. 8, 1887) advocates Sonnenburg's operation, which consists in removing the defective bladder and turning the ureters into the penis. The object of the present paper is to describe a special receptacle devised by the author, to be worn after Sonnenburg's operation. It consists of two parts—a rounded concave shield to cover the abdominal wound, and a scrotal funnel, which receives the scrotal tissues and the rudimentary penis, and leads into a tube emptying itself into an ordinary urinal. The shield and funnel are made of silver, and the points of contact are covered with an India-rubber tube, as on the edge of an ether inhaler. A case is described where the appliance was used. The patient was always kept perfectly dry. Excellent illustrations accompany the paper.

SUPRAPUBIC LITHOTOMY.

SIR WILLIAM MACCORMAC (*British Medical Journal*, 1887, vol. i. p. 551) contributes another valuable paper upon this subject. The article commences with an account of the history of the operation. The modern method is described as follows: Strict antiseptic precautions are adopted throughout. The rectum is distended by an India-rubber bag, of elongated sausage-form. 10 to 12 ounces are injected. The bladder is emptied, is washed out, and then moderately distended with boric solution (6, 8, or 10 ounces). The bladder will then be readily felt above the pubes. The incision is median, is close to the pubes, and from 2 to 4 inches in length. The tissues are divided layer by layer, until the bladder is distinctly exposed. After the viscus has been secured by two loops of thread passed through the muscular coat at the upper exposed part, the cavity is opened. The stone is then removed. In young persons with healthy urine the wound in the bladder may be closed by sutures, in other cases the wound may be left open with or without drainage.

The author gives an account of a series of experiments performed to ascertain the effect of distention of the bladder and rectum upon the position of the peritoneal reflection. When the bladder alone is distended, the peritoneal reflection is somewhat but not sufficiently raised, the bladder being chiefly distended backward. Distention of the rectum alone appears to produce no palpable effect on the vesical fold; and to obtain the maximum result, distention of both bladder and rectum seems necessary. The dilatation of the rectal bag pushes the moderately distended bladder forward and upward against the parietes.

The following indications for the operation are given: A large stone in a contracted bladder, a stone projecting into the urethra, encapsulated or very hard calculi, cases of numerous stones, certain foreign bodies, ricketty deformity of the pelvis, and ankylosis of the hip-joint. Some add hypertrophy of the prostate, stricture, and irritable bladder.

The mortality after the suprapubic method is from 22 to 30 per cent. The commoner causes of death are (in order) peritonitis, pericystitis, pyelonephritis, collapse.

In 26 cases of suture of the bladder wound primary union was obtained in 10 cases only.

LITHOTOMY.

DR. ROSENTHAL (*Vratch*, 1886, Nos. 25–32) gives the following valuable statistical account. He deals with 400 cases of lateral lithotomy. 47 per cent. of the cases concerned patients under seven years of age, and 66 per cent. patients between seven and thirteen years. Out of the 400 only 40 died, a mortality of 10 per cent. In 6 of the fatal cases, death was not directly due to the operation, and the omission of these raises the mortality to 8.5 per cent. The mortality increased steadily according to age, being 3.5 per cent. in patients under five years, and 36.8 per cent. in patients between the ages of thirty and sixty-six.

The mortality in 7628 recorded cases of lateral lithotomy collected by the author is 12.08 per cent. The mortality of the suprapubic operation, on the other hand, stands at 22.1 per cent.

Out of the 40 cases of death, 17 died of pyonephritis. The rectum was wounded 6 times in the 400 operations.

The time occupied in healing averaged 18.6 days in patients under ten years, and 27.2 days in patients above that age.

The character of the calculus was determined as follows: urates, 70 per cent.; oxalates, 11 per cent.; mixed (phosphates predominating), 19 per cent.

PRIMARY SARCOMA OF THE BLADDER.

DR. CHIARI (*Prager med. Wochenschrift*, 1886, No. 50) reports a case of this very rare affection. He states that only seven cases have so far been reported. The patient was a boy aged five; the first symptoms were those of retention, followed by the manifestations of chronic cystitis. No blood appeared in the urine until a catheter was used. The tumor could be felt through the abdominal parietes. The tumor sprang from the submucosa about the trigone. The prostate and seminal vesicles were invaded. A solitary gland was found enlarged. There were no other metastases. The growth proved to be a pure spindle-celled sarcoma.

THE FUNCTION OF THE PROSTATE.

DR. FÜRBRINGER (*Berliner klin. Wochenschrift*, 1886, No. 29) states that the prostatic fluid is thin and acid, is rich in albumen, contains lecithin but no fat. The author believes that the fluid has other functions than that of a mere lubricating medium. He states that it acts as a vitalizer of the seminal fluid, and is of essential importance in the act of generation. In semen unmixed with the prostatic secretion the spermatozoa are found to be stiff and still; on the addition, however, of that fluid, they become at once subtle and active. The addition of an excess of prostatic secretion causes the seminal particles to become once more indolent.

These statements are founded upon observations made on animals, and on certain pathological experiments carried out upon the human subject.

RENAL SURGERY.

T. F. CHAVASSE (*Lancet*, 1887, p. 403) gives an account of three cases that proved fatal after operation. In his comments upon these cases the author deduced the following conclusions: To obtain the greatest possible benefit from operative measures renal calculi must be sought for and removed before destruction and consequent abscess have resulted. The signs and symptoms most to be relied upon for the diagnosis of renal calculus, where no tumor exists, the patient being otherwise healthy, are the following: 1. The presence of blood in the urine, especially after erection. 2. Unilateral pain passing down the ureter toward the testis. 3. Pain on deep pressure in loin between the last rib and the iliac rest and just external to the erector spinæ muscle. 4. The presence of uric acid and oxalate crystals in the urine. In suppurative lesions of the kidney nephrotomy and drainage should be the first measure in treatment.

In one case the author passed an exploring needle twelve times into the substance of the kidney, but failed to reveal a calculus and a fair sized abscess that were ultimately discovered post-mortem.

Speaking generally, there is no doubt that the lumbar incision is safer than the abdominal. The author advises nephrectomy under these conditions: After nephrotomy and drainage have failed in cases of suppurative lesions depending upon a local irritant, in hydronephrosis, and in traumatic rupture of the kidney. It is justifiable also in cases of painful floating kidney when attempts to free the organ have failed, and in troublesome renal or ureteral fistulæ. Nephrectomy is contraindicated in tubercular disease, carcinoma in adults, and sarcoma in children.

The following articles are worthy of note:

"Abscess of the Brain Resulting from Ear Disease," by Dr. Thomas Barr (*Brit. Med. Journ.*, April 2, 1887).

"Pianists' Cramp," by Dr. Warrington Howard (*Brit. Med. Journ.*, March 26, 1887).

"Case of Mollities Ossium in a Male," by Mr. Barwise (*Brit. Med. Journ.*, April 9, 1887).

"Laparotomy in Intestinal Obstruction," by Dr. Kümwell (*Deutsche med. Wochenschrift*, No. 12). Four cases: two of volvulus, one of mesenteric hole, one of solitary band. Laparotomy in each instance, with only one recovery.

"The Theory of Gut Strangulation," by Dr. Beeby (*Centralblatt für Chirurgie*, No. 14, 1887). An examination of Reichel's view, with a new and elaborate theory of the author's.

"Chondromyosarcoma of Kidney," by Dr. Hoiaholt (*Virchow's Archiv*, Bd. civ. p. 118). Male, aged eighteen; left kidney. Died of marasmus. Tumor composed of round-celled sarcoma mixed with muscle fibre and nodules of cartilage.

"Seven Consecutive Cases of Charbon Treated Successfully by Excision," by Thomas Bryant (*Lancet*, 1887, vol. i. pp. 367 and 416).

"Case of Trephining over the Left Branchial Centre for Paralysis of the Right Arm due to a blow a week previously. Cure," by A. W. Robson (*Lancet*, 1887, vol. i. p. 464).

"On Sounding the Frontal Sinus," by Dr. Jurasz (*Berliner klin. Wochenschrift*, No. 3, 1887). The probe is introduced from the nose. The utility of the procedure is not evident.

"Vesical Fistula after a Radical Operation for Hernia," by Dr. Feilchenfeld (*Berliner klin. Wochenschrift*, No. 3, 1887). Male, aged fifty-one; scrotal hernia. Removal of sac with ligature of neck. Urinary fistula formed at wound, which closed after many weeks. The author supposes that a vesical diverticulum must have been engaged in the ring.

"The Classification of Tumors of the Testicle," by Drs. Monod and Arthaud (*Revue de Chirurgie*, March 10, 1887).

"Malformations of the Anus," by Dr. Jeannel (*Revue de Chirurgie*, March and April, 1887).

In America.

Removal of a Large Sarcoma, causing Hemianopsia, from the Occipital Lobe.

Drs. W. R. Birdsall and Robert F. Weir (*The Medical News*, April 16, 1887) make a most important contribution to brain surgery; among other points demonstrating that hemorrhage must be primarily arrested in operations involving the brain structure by reliable methods, such as the ligature, torsion, or prolonged forcipressure, and not by the tampon.

A man, æt. forty-two, in August, 1885, suddenly noticed unsteadiness of gait, succeeded by a violent attack of vomiting. Diplopia for distance soon appeared, with increasing muscular incoördination; numb sensations of the right arm, leg, and shoulder; but no disorder of sensation of the face. All these symptoms were intermittent. Occasional moderate frontal headache was experienced. No vertigo was noticed at first, and no other sensory, motor, or visceral symptoms appeared. Hemianopsia, was detected, with incipient neuro-retinitis. The diagnosis was, "tumor of mesial aspect of right occipital lobe, involving primarily the cuneus, extending downward toward the tentorium cerebelli, and perhaps also upward toward the paracentral lobule (leg centre)." Slight improvement in gait, under the use of iodide of potassium, was observed until as late as July, 1886; but in September the muscular incoördination and occasional drowsiness rapidly increased.

Examination now showed the left lateral hemianopsia still present; the neuritis well advanced, although more marked in the left eye; irides active, both to light and accommodation—the left pupil larger than the right; no diplopia, no "ocular paresis;" the special senses were normal, and there was neither anæsthesia, analgesia, disturbance of the temperature sense, paresis, nor tremor of the muscles; and the motions were "clumsy," rather than ataxic—"uncertainty of control" seemed the best term for it; and the disturbance of equilibrium increased in a most irregular manner.

On March 9, 1887, Dr. Weir operated antiseptically. An oval opening, two and three-quarters by two and one-quarter inches, was made through the bone by means of a trephine and the rongeur. The non-pulsatile dura mater was opened for two-thirds of the extent of the bone wound, and the tumor, of a purplish-red color, presented at once, covered by a thin cellular layer containing large ramifying veins. By means of a director and spoon-handle, a thin layer of brain substance was loosened from its outer side, and by a continuance of these proceedings the growth was readily separated at the sides; but even after further free removal of bone tissue, the outlying edges and base of the growth could not be reached until it was incised and its softened interior squeezed out. After this, separation was readily effected by the finger-nail until the base was reached, when the growth was nearly torn in half, its outer portion lifted out, separated from the falx, and the whole mass withdrawn. Considerable venous oozing occurred, but was readily arrested by sponge pressure. Two bleeding points were seen: one venous, in the region of the straight sinus; and the other arterial, possibly a terminal branch of the posterior cerebral artery. Moderately firm packing with iodoform gauze to check bleeding, partial suture of the dura mater and scalp, with a careful antiseptic dressing, completed the operation. Some failure of the pulse was observed when the growth was being lifted out, probably due to loss of blood —in all, computed to be from f℥x to f℥xij—but hypodermatics of whiskey relieved this condition.

After the rapid recovery from the anæsthetic, slight divergent squint of the left eye was noted; the pulse was 132, regular, and of good volume. Enemata of milk punch were ordered every two hours. Two hours after operation the pulse was 120, weak, and there was much blood-staining of the dressings.

At 10 P. M. the patient was very restless, with an extremely weak pulse, and steady bleeding was evidently going on. Two quarts of salt solution, as modified by Landerer, were slowly injected into the median basilic vein with immediate improvement in the pulse and consciousness. Slight paralysis of the ocular branch of the seventh nerve was now detected, in addition to the already noted divergent squint on the left side. Hemorrhage being evidently the cause of the unfavorable symptoms, the dressings were removed, but such free bleeding occurred as to forbid anything more than the application of an additional iodoform gauze tampon, and a second transfusion was made; but, despite everything, death occurred at 2 A. M.

Dr. Weir regrets that forcipressure forceps, allowed to remain for from twenty-four to forty-eight hours, with elevation of head, had not been resorted to at the outset. The advisability and dangers of free bone openings are discussed, bone-grafting is advocated, either by dusting the finely minced bone over the dura mater, or by replacement of the trephine disks.

This case makes the eighth operated on for brain tumor. In five instances the growth was found and removed; in one, partial removal was effected; and in the remaining two, no tumor was found, although in one case the postmortem, two and a half months later, revealed a growth pressing upon the cerebellum and spinal cord.

The growth weighed 5¼ ounces, and measured 3¼ inches by 2¾ by 2½ inches thick, the greater circumference measuring 8½ inches.

Pleurotomy by Resection of the Ribs for Empyema.

Dr. W. H. Strickler (*The Medical News*, May 7, 1887) describes the following operation: Across the sixth rib in the axillary region a vertical cut of three inches is made with its centre over the rib. A transverse cut of one inch crosses the primary one at its centre. The sixth rib is bared, partially divided at two points by a Hey's saw, and finally severed by bone forceps. The pleura now being opened the chest is explored by the finger to ascertain the position of the diaphragm, when a section of the seventh and of the fifth ribs is removed—about one inch of these, while the exsected portion of the sixth rib measures one and a half inches; this is to secure space between the extremities of the segments of this rib, when the cut ends of the fifth and seventh ribs are driven together by atmospheric pressure. All bone sections having been completed, the pleural cavity is carefully explored, by the whole hand, except the thumb, all fibrinous masses are carefully removed, any bands likely to prevent expansion of the lung ruptured, and the cavity thoroughly irrigated with large quantities of hot water. All but the centre of the wound is sutured, and gauze and oakum applied over all. After the first week a tube is used to keep the wound patent, which is gradually reduced in size. From the outset, daily flushings with hot water are used. Five cases are reported, which have done well. The operation is a modification of one in general use.

Pistolshot Wound of the Abdomen; Laparotomy; Nephrectomy; Autopsy.

Dr. W. W. Keen (*The Medical News*, May 14, 1887) gives the details of a most interesting case, which should be carefully studied by every surgeon, illustrating, as it does, many points which are both new and of practical importance in this latest field of operative surgery. The title contains nearly all the essential points, and since nothing short of an almost complete reproduction of the paper could do it justice, we shall merely add what seems to be the apparent cause of the fatal termination of a case which bade fair to recover, and one or two minor points worthy of comment. Generalized, non-suppurative peritonitis was found post-mortem, and a gangrenous portion of bowel opposite to the ball wound of the intestine, in the centre of the dead portion two perforations existing with pus in the lumen of the bowel. This was probably the cause of the peritonitis, and Dr. Keen thinks resulted from contusion of the mesentery not detectable at the operation, but causing thrombosis of the arterial supply to the portion of bowel-wall which necrosed. An extensive intermesenteric layer of blood effused before, and found at the operation, had also broken down and looked purulent, but did not communicate with the peritoneal cavity. At the post-mortem examination the right kidney was found to have undergone marked compensatory enlargement, which the clinical history indicated must have taken place, since the urine, while scanty at first, gradually increased in three days from ℥iij of albuminous fluid to ℥xl of normal secretion.

Splenectomy for Wandering Spleen.

Dr. W. H. Myers reports (*Journal of the American Medical Association*, April 2, 1887) a successful case, the operation being demanded for the relief of septic symptoms induced by abscess, resulting apparently from the pressure of an enlarged and dislocated spleen. The suppuration was unquestionably favored by the post-partum state, the patient having been delivered about three weeks previously, although the splenic hypertrophy had existed to a marked degree for over one year. The perisplenic abscess had opened externally before operation by three orifices. Strict antisepsis was attempted and secured. The pedicle was transfixed by a double ligature, tied in halves, and dropped into the cavity, and a glass drainage tube inserted. The tumor weighed seven pounds. Recovery was prompt, the patient going home on the twenty-first day.

ANEURISMS TREATED BY THE INTRODUCTION OF CATGUT OR OF WIRE, WITH ELECTRICITY.

In this most interesting paper (*The Medical News*, April 9, 1887) DR. ROBERT ABBE reviews the histories of those cases treated by wire alone, and then relates an instance in his own practice, where the introduction of one hundred feet of aseptic No. 1 catgut into the cavity of a large dissecting aneurism of the right subclavian artery was of temporary benefit. Increase in size occurring after a few days, one hundred and fifty feet of fine sterilized steel wire were introduced through an insulated aspirator needle, the positive pole of a galvano-faradic battery was attached to the extremity of the wire, while a copper plate—12 inches by 12 inches—covered with wet cotton, placed over the back, was connected with the negative pole. A current of fifty milliampères was at first used, finally a very much stronger current, the current being reversed during the latter part of the operation, which occupied one hour. For twenty-four hours decided hardening of the tumor was noted, then it rapidly increased, death resulting on the second evening from rupture into the trachea.

The writer reviews the results of this, and similar treatment, in the practice of others, concludes that, as it has only been tried in desperate cases, we are not able to decide what value inheres to the practice, and thinks that, as it does no harm, it should be still tried—all the more, as the post-mortem results show that in many cases large quantities of firm, laminated clot have been formed, while "the subsequent much-desired inflammation of the sac was easily kept under control by ice-bags in every case." Two cures have resulted from the introduction of wire, while electrolysis alone has occasionally succeeded. In reality, Dr. Abbe has combined both methods—*i. e.*, introducing a tangled mass of easily compressible wire reaching every portion of the sac, and then inducing deposition of clot upon it by electrolysis; in addition, inflammation of the sac, which Cinicelli contends is essential to the success of his method, is induced.

A CASE OF INNOMINATE ANEURISM TREATED BY SIMULTANEOUS DISTAL LIGATION OF THE RIGHT CAROTID AND SUBCLAVIAN ARTERIES. RECOVERY.

DR. H. R. WHARTON records (*The Medical News*, April 9, 1887) the history and results of treatment of a case operated upon by Professor J. Ashhurst, Jr., at the University College Hospital, on November 13, 1886. The right common carotid was ligatured with catgut above the omohyoid muscle, after which the subclavian of the same side was secured just outside the anterior scalene muscle. Silver sutures, drainage tubes, and an oiled lint dressing were used. Neither unpleasant cerebral symptoms occurred, nor did improvement in the aneurism at first take place. In a few days, however, the aneurismal tumor became smaller, the dyspnœa and dysphagia markedly diminished, and the patient could sleep in the recumbent posture. No radial pulse was detectable even when discharged two months after operation. Examination at that time showed only the merest traces of the previous trouble, so slight, indeed as to warrant the belief that a complete cure has resulted. The recorded cases of this operation are examined and commented upon, the results of consecutive ligation compared, and the opinion expressed that the simultaneous ligation of the right carotid and subclavian arteries for innominate aneurism "is a more efficient and safer procedure than consecutive ligation of these vessels."

THREE CASES OF LIGATURE OF THE EXTERNAL CAROTID ARTERY, IN TWO OF WHICH BOTH VESSELS WERE TIED SIMULTANEOUSLY.

DR. JOS. D. BRYANT (*The Medical News*, May 14, 1887), in a lengthy paper, well worthy of a careful perusal, sums up with the following conclusions: 1. Ligature of the external carotid artery, together with independent ligature of the branches arising from the first inch of its course, is a safe and commendable operation. 2. When the facial and lingual arteries do not arise singly, or by a common trunk, from the first inch of the course of the external carotid, the branches arising at the point of bifurcation of the common carotid should be tied. 3. Simultaneous ligature of both external carotids is a rational preparatory measure for operations involving the parts supplied by their branches when dangerous hemorrhage is feared. If the pharynx be involved, the ascending pharyngeal branches should be ligatured also. 4. Simultaneous ligature is advisable as a final expedient to diminish the rapidity of the development of extensive, malignant growths when they are nourished by the branches of the external carotids. 5. Ligature of one or both external carotids for the cure of aneurismal formations of the branches of the same is not feasible as an independent curative measure. 6. Ligature of the common carotid should not be done for the cure or for the arrest of morbid conditions involving the external carotid or its branches, except as a final resort.

THE TREATMENT OF OLD DISLOCATIONS OF THE ELBOW.

DR. L. A. STIMSON reports, in *The Medical News* for April 2, 1887, a case in which arthrotomy was resorted to, and upon the reproduction of the displacement, excision of the joint was done two months after the first operation.

Attention is called to the adhesions formed by the remains of the lateral ligaments and adventitious cicatricial bands between the olecranon and humerus, which take place so far up and behind the centre of motion that reduction can only be effected by a greater degree of force than originally produced rupture of the articular ligaments. Stripping up of the periosteum on the dorsum of the humerus by the head of the radius occasionally takes place, with a consequent formation of bone greatly interfering with reduction. Removal of pressure from a growing epiphysis—*i. e.*, that of the capitellum of the humerus—may result in an overgrowth of this process in the young, while elongation of the neck of the radius may take place from the same cause, both of these conditions preventing reduction. Fractures of portions of the coronoid process, the head of the radius, or of the epitrochlea, may, by subsequent bony adhesions in new sites, present insuperable obstacles to replacement of the articular surfaces.

Stimson, in his arthrotomy, made a single, instead of the usual bilateral incision—which latter procedure he announces he intends adopting in the future—divided the olecranon, separated adhesions, reduced the luxation, and then sutured the divided bones with silkworm gut. Owing to the strain exercised upon the olecranon by the tense triceps muscle, the elbow had to be fixed at an angle of 145 degrees, a position which doubtless determined the redisplacement.

Dr. Stimson concludes by stating his acceptance of the rules formulated by Albert for cases of old backward luxation of the elbow, viz., rupture or tenotomize adhesions in the elderly, and if reduction then fails, forcibly flex the elbow to a right angle, with or without fracture of the olecranon, and allow ankylosis to occur. In younger subjects divide subcutaneously all bands, and even the triceps, to avoid fracture of the olecranon; but if the bones cannot then be replaced, arthrotomy should be done by two lateral incisions. Finally, if everything fail, excise the joint.

OPHTHALMOLOGY.

UNDER THE CHARGE OF

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OPHTHALMOPLEGIA EXTERNA ACUTA.

In the *Edinburgh Medical Journal* for March DRS. BERRY and BRAMWELL report a case of ophthalmoplegia externa acuta in a child of two and a half years, probably due to a scrofulous lesion of the pons Varolii, with subsequent recovery. The authors admit that the exact nature of the lesion must, to some extent, be a matter of conjecture, but were disposed to think that it was probably tubercular from the sudden nature of the attack and the clinical history of the case. The ocular symptoms manifested themselves as follows: Almost complete ptosis of both lids, inability to elevate the eyes, complete loss of the power of depressing them; the internal rectus of the right eye was absolutely, and that of the left almost completely, paralyzed; absolute divergence of the eyeballs, the pupils from four to five mm. in diameter, which contracted promptly to light. There were no visible changes of the fundus oculi. Dr. Berry's diagnosis was paralysis of the third and fourth nerves and paresis of the sixth—*i, e.*, almost complete ophthalmoplegia externa.

By careful examination, no loss of sensation or derangement of motion could be elicited other than could be accounted for by the general apathetic and drowsy condition of the patient. The authors localized the lesion at the top of the pons Varolii and in the neighborhood of the aqueduct of Sylvius, from the fact that the muscles supplied by the third, fourth, and sixth nerves on both sides were involved and vision unaffected. The prompt pupillary reaction demonstrated that it was not the trunk of the third nerve but only those nuclei connected with the external muscles of the eyeball which were implicated. The fifth nerve was apparently unaffected.

The authors bring to their support the researches in the localization of the motor functions of the eye by Henson and Völckers, Kahler, Pick, and Ferrier. The labors of Henson and Völckers have established the fact of a differentiation of centres of the third pair of nerves, so that each of the ocular muscles, the levator, the superior, inferior, and internal recti, and the inferior oblique, has a distinct and localized nuclear origin beneath the floor of the aqueduct of Sylvius; moreover, the centres for the reflexes of light and accommodation (the iris and ciliary muscle are not only distinct from the preceding but from each other) are placed further forward toward the summit of the third ventricle. From these anatomical differences of origin we can understand how there may be ophthalmoplegia externa whilst the pupillary and ciliary reflexes are perfectly normal; and also how the reflex to light may be abolished with conservation of the accommodative reflex as in the "Argyll-Robertson pupil."

The differential diagnosis between ophthalmoplegia of nuclear origin and that arising from peripheral lesion depends on the following symptoms: In the first instance there is a slow, gradual, and progressive suppression of ocular motility, with a moderate degree of ptosis that may be temporarily overcome by the will, and with normal pupillary and accommodation reflexes. In paralysis of peripheral origin, the failure of function is monolateral, sudden, subject to no changes or intermissions, and if existing, the ptosis is not controllable by the will. This latter phenomenon finds its explanation in the clinical and physiological fact that the levator is the only one of the ocular muscles whose relations with the cortex have been established.

The patient recovered under the internal administration of the iodide of potassium.

IMPERFECT CONVERGENCE IN EXOPHTHALMIC GOITRE.

P. J. MÖBIUS (*Centralbatt für Nervenheilkunde*) finds a subnormal converging power in patients with Basedow's disease, the remarkable fact being that the imperfection is independent of the proptosis, since in two cases when the proptosis was marked, convergence was normal, and in the other six cases, varying greatly in the degree of proptosis, the imperfect convergence was decided. The author concludes that the phenomenon is due to the nervous debility, and cites Perinaud, who found a reduced power of convergence in neurasthenic patients.

SYPHILITIC ARTERITIS OF A RETINAL ARTERY.

In the *Correspondenz-blatt für Schweizer Aerzte,* HAAB reports a case believed to be unique, of pronounced arteritis of one of the branches of the retinal artery, due to syphilis. The trunk of the artery showed spots of brilliant whiteness, often resembling white scales, whilst in the smaller subdivisions of the branches the change was shown throughout. These lesions were markedly lessened by constitutional treatment directed against the general syphilitic condition.

Physiological action of Atropia on the Iris.

Dr. H. Höltzke in *Klinische Monatsblätter* for March, asserts that mydriasis of the pupil following instillations of atropia, is caused by paralysis of the nerve endings of the oculomotorius only. His statement is based upon experiments made upon lower animals, where the pupil had been dilated by atropia and the sympathetic nerve severed; the pupil immediately after the operation contracted; by the application of faradization dilatation follows. Contraction and dilatation of the pupil have been observed in a non-atropinized eye, where the same experiment has been made.

Stilling advances the argument that atropine not only paralyzes the nerve endings of the oculomotorius, but also irritates the sympathetic, and brings to his support the fact that in paralysis of the third nerve, due to some lesion, where we have a certain amount of pupillary dilatation (about five mm.), an application of atropia will dilate the pupil still further (8 mm.). He argues that the atropia irritates the sympathetic, thereby producing secondary mydriasis.

Höltzke explains this as follows: Inasmuch as the lesion is along the trunk of the nerve, there still remains a certain amount of force in the ganglion cells situated in the iris or anterior portion of the uveal tract or ciliary ganglion, which gives a certain amount of remnant tonicity to the peripheral ending of the nerve, it being these cells which the atropia affects, and thereby producing the secondary dilatation. Cocaine produces mydriasis of the pupil by its irritant effect upon the sympathetic, hence the secondary dilatation in an atropinized eye. Our author sets forth this fact in support to his primal assertion that atropia only acts physiologically upon the third nerve when applied to the eye.

Snow-blindness.

Dr. L. B. Graddy, of Omaha, Neb., had under observation six patients suffering from snow-blindness. They were hunters, following their occupation in a district covered with snow. The intense glare of the sun reflecting from the snow produced the visual defect. The first manifestation of disturbed vision was their inability to outline game (wild geese) below the horizon. The visual defect increased to such a degree that landmarks which guide men on the plains, faded rapidly away, and it was with difficulty that they found their way into camp. Forty-eight hours after the attack, the victims were found by Dr. Graddy suffering intensely with photophobia, lachrymation, conjunctivitis, ciliary neuralgia and, in two cases, complicated by a narrow, horizontal band of superficial keratitis. The patients described their condition as if enveloped in a white, heavy mist. As their faces were sunburned, Dr. Graddy assumes that the pathological condition of the conjuctiva and cornea was of the same character, and the blindness due to molecular change in the retina, caused by over-stimulation.

The treatment instituted was soothing external applications and dark rooms. Recovery followed, with useful vision.

Indians and trappers have an ingenious way of protecting vision, where the glare is intense, by applying around the eyes, and over the cheeks, a gunpowder paste, or goggles made of the untanned skin of animals, fitting closely around the orbit.

MYOPIA IN THE SCHOOLS OF STOCKHOLM.

In an examination of 1446 school children of Stockholm, PROFESSOR JOHAN NIDMARK found no myopia in children of six or seven years of age, whilst among scholars of eight and nine there was, among girls, but one case; among boys 14 per cent.; at sixteen, 33 per cent. of boys and girls were myopic, with an average of —2.5 D. In the highest grades the proportion of myopes among the girls rose as high as 54.28 per cent., with an average degree of —3.5 D., the frequency among boys not being so great, one school (girls) showed a frequency of 66.67 per cent., and a mean of —4.16 D. The statistics show that the injury is greater to the eyes of girls, a result to be expected, both on account of the comparative weakness of females, and the nature of their work outside of school.

SILVER BALLS AS SUBSTITUTES FOR THE VITREOUS AFTER EVISCERATION.

In the report of the Bristol General Hospital (*British Medical Journal*) two cases of the successful use of hollow silver (instead of glass) balls is detailed, for the substitution of artificial vitreous after evisceration, by MR. W. P. KEALL. The evisceration was thoroughly performed under antiseptic precautions. The ball was of a size easily enclosed by the sclerotic. The opening in the sclerotic was made just outside of the sclerocorneal margin in a horizontal and curved direction, whilst that of the conjunctiva was vertical, in order more effectually to close the hollow of the eye. The wounds were stitched with fine silk thread. The dressing was a pad of boracic lint moistened with carbolic lotion. No pain was experienced from the pressure of the balls, and in a few weeks all inflammation and discomfort had disappeared.

GOUTY AFFECTIONS OF THE EYE.

M. ZYCHAN (*Recueil d'Ophthalmologie*) describes the ocular symptoms consequent upon gout. The sclerotic is most frequently attacked, though the lachrymal ducts, the lids, and other parts are sometimes affected; vascular congestion and swelling are usually the most noticeable objective symptoms; calcareous deposits have been found under the conjunctiva of the upper lids near the margin, producing by the friction (as in trachoma) irritation of the conjunctiva of the globe, photophobia, etc. The deposits may be extracted or picked out with any sharp instrument. If dry eczematous scales form upon the lids, with intense itching, the author recommends dusting the parts with calomel or calomel and morphine combined. The capillary degeneration of gouty subjects is shown by conjunctival hemorrhages and extravasations.

TRANSPLANTATION OF RABBIT'S EYE INTO THE HUMAN ORBIT.

DR. CHARLES H. MAY reports the failure of an attempt of this kind in the *Archives of Ophthalmology* for March, 1887. The attempt is noticeable only because every circumstance attending the whole proceeding was as favorable to success as desired. The patient's health was all that could be wished, the operation was done with skill and care, and with every precaution, antiseptic and otherwise, that could be demanded; the subsequent events were all favorable to a successful result, but on the ninth day ulceration of the transplanted eye began to appear, and it was removed. The muscles and optic nerve had united more or less firmly, but the mass of foreign tissue proved too great; its nourishment was impossible under such circumstances.

ARTIFICIALLY PRODUCED CATARACT.

In *La Semaine Médicale*, MESSRS. BOUCHARD and CHARRIN state that naphthalin produces cataract of both eyes in rabbits; it requires three to four weeks, daily doses of about twenty-five grains, to produce this result.

In examining the functions of the cochlea, DR. STEIN found that the persistent action of a high-pitched tuning fork produced cataract in young porpoises in from eighteen to twenty-four hours. The opacity of the lens passed off in time, but could be reinduced by the tuning fork. In animals whose ears had been destroyed, the cataracts were producible in two or three hours.

A NEW CAUSE OF MYDRIASIS.

Dr. RAMPOLDI (*Recueil d' Ophthalmologie*, March, 1887) calls attention to bronchial and pneumonic affections as frequent sources of unilateral (sometimes bilateral) mydriasis. He has noted the fact, especially after the patient has passed a sleepless night from cough, and explains the phenomenon as a result of irritation of the cervical sympathetic which supplies the radiating fibres of the iris.

CATARACT EXTRACTION WITHOUT IRIDECTOMY.

In the *Archives of Ophthalmology* for March, 1887, DR. H. KNAPP reviews the reasons for and against a preceding iridectomy in cataract extraction. His conclusion is: "Simple extraction is an operation of the highest order, and practicable in the majority of cases with the same degree of safety as the extraction combined with iridectomy. In a considerable minority, however, the latter method is preferable; in a number of cases the indications for the iridectomy manifest before, in others only during, the operation." He concludes that an iridectomy should be made when, from fluidity of the vitreous and rupture of the suspensory ligament, or from insufficient section, the vitreous, instead of the lens, presents; when the iris has been injured, when the sphincter is unyielding, when, subsequent to the expulsion of the lens, the iris proves irreducible.

Of the twenty-nine cases detailed which served as clinical proof of the results, there were eighteen "perfect or ideal recoveries"—*i. e.*, the pupil was central and movable, and unobstructed by inflammatory products. The advantages of the operation without iridectomy are evident; there is a normal and active pupil, a natural appearance of the eye, increased acuteness and better eccentric vision, etc. On the other hand, the operation is somewhat more difficult, the section larger, the lens less easily expelled; there is greater danger of prolapse of the iris and posterior synechiæ.

IRRIGATION OF THE ANTERIOR CHAMBER AFTER CATARACT EXTRACTION.

In *Annales d' Oculistique* for January, 1887, DR. GRANDCLEMENT, of Lyon, reviews the method adopted, and the nature of the liquid used by MacKeown, Wicherkiewicz, and Panas for irrigation of the anterior chamber after cataract extractions. Wicherkiewicz reduced the practice to a method for operations upon immature cataracts, instead of artificial maturation. Wecker made these injections, containing a solution of the salicylate of eserine, in order to secure pupillary contraction and to prevent prolapse of iris; Panas requiring not only cleansing, but also antiseptic properties.

Inasmuch as the usual antiseptics, such as the bichloride of mercury or phenic acid, were too irritating, he employed the biniodide of mercury (0.05 gramme to 1000 grammes, with 20 grammes alcohol, at 90°), which he found successful, patients usually recovering in seven days. Grandclement performed four cataract operations, following the details as suggested by Panas, excepting the strength of the solution, which was but half strength, for fear of producing too much irritation.

In the first case the solution was used thoroughly. The vision immediately following the irrigation was excellent, but in twenty-four hours, and still more marked on the second day, the cornea was striated and lacked transparency. The iris and capsular sac became involved and the final result was not brilliant.

The three cases following responded more favorably to the treatment. Our author found the intra-capsular irrigation, as practised with Panas' solution, dangerous, and according to experiments made upon rabbits by Drs. Bettremieux and Vassaux, disciples of Panas, the salts of mercury should be abandoned. For operations upon immature cataracts our author now uses boiled and sterilized water, having abandoned all antiseptic liquids as dangerous and useless, there being no microbes in the eye; besides, the recent investigations and experiments of Prof. Sattler prove that Panas' solution is absolutely too weak to kill the numerous microbes which he found in the lachrymal sac and secretions of the conjunctiva of individuals suffering from catarrhal inflammation of the lachrymal ducts. To destroy the microbes a solution four times the strength would be required—much too irritating to apply to the eye. Boracic, salicylic acid, and other substances reputed antiseptic, Sattler found useless in the destruction of micrococci.

With patients having cataracts and suffering from catarrhal inflammation of the lachrymal canal, our author suggests the application of the sublimate, 20 centigrammes to 1000 grammes, for a shorter or longer time, to the palpebral aperture until a violent conjunctivitis is produced, this is then mastered by astringent washes, and the operation for cataract, or, what is still safer, a preliminary iridectomy performed. Five or six weeks subsequently the lens may be removed through the scar-tissue, which must be less favorable to the evolution of morbid germs. Our author has followed this method with good results, not depending upon boracic acid, which seems too much in vogue to-day. The reviewer has found boroglyceride, fifty per cent. solution, a most efficient remedy is cases as described above.

TRANSPLANTATION OF THE CORNEA.

In Zahender's *Klinische Monatsblätter* for February, 1887, **PROF. ADIMUK** reports his attempts at corneal transplantation into human eyes, emphasizing the recommendation that an adjacent portion of sclerotic be also transplanted.

This is in view of the fact that the cornea is nourished from its periphery, and that the sclerotic heals more rapidly than the cornea. It therefore became necessary to choose some animal having an eye small enough to enable the operator to procure a piece (by trephining) of the requisite tissues and size. Three attempts were made with rats' eyes; the tissues proved too thin and weak to withstand the intraocular pressure of the human eye. But there was union and healing of the transplanted part, and this gave encouragement to other attempts.

Five trials were made with hen's eyes. Two ulcerated, and three grew firmly in place, but these cases subsequently passed out of observation, and no definite results can be stated. The author, however, urges that his partial success renders the method of including a bit of the sclera with the transplanted piece a prerequisite of success. The method whereby this opaque part subsequently becomes transparent by a spontaneous process is hard to believe. It is evident that the success of the endeavors must depend upon a more perfect technique. Personal disappointments and the scepticism of others have not discouraged v. Hipple, who recently successfully ingrafted a rabbit's cornea (4 mm.) in the opaque cornea of a girl seventeen years old. The visual acuity at the end of eight days was $\frac{20}{\mathrm{cc}}$. The investigations of Leber upon the liquid changes of the eye have taught us that the transparency of corneal tissue is only protected by the intact state of Descemet's membrane, hence the transplantation is made possible, only if the endothelium of this membrane preserves its integrity. If the membrane is wounded it rolls upon itself, and failure is the result. The method, which is difficult and delicate, is applicable only to non-adherent leucomas, according to von Hipple.

Inflammation of the Lachrymal Canal.

Dr. Montanelli (*Bolletino d' Oculistica*) reports that two cases of dacryocystitis, which proved rebellious to the usual line of treatment, responded promptly to the daily irrigation of the canal of a solution of boracic acid (40 in 1000) with one gramme of salicylic acid. The injections were made with a perforated nozzle introduced in the upper lachrymal duct, and this probe attached to a rubber tube terminating in a reservoir placed 90 centimetres above the level of the eye.

Ocular Injuries caused by the Obstetric Forceps.

Berger (*Archives für Augenheilkunde*, March, 1887) reports a case of ocular injury caused by obstetrical forceps, which, from its rarity, attracts attention. The levator palpebræ was so injured that the child (of four years) suffered with marked ptosis, and an almost complete lack of power of the rectus superior. Fundus oculi was normal, the refraction hyperopic and astigmatic, vision $\frac{20}{\mathrm{xxx}}$. Three other cases of ocular injuries by forceps are all that are recorded in ophthalmic literature. These are by Steinheim, in the *Deutsche medizinische Wochenschrift*, 1883, No. 17.

INCISION OF SWOLLEN OPTIC NERVE SHEATH, AND ETIOLOGY OF "CHOKED DISK."

MR. BRUDENELL CARTER (*Lancet*, March 26, 1887) reported to the Medical Society of London an interesting and successful instance of incision of the nerve sheath, and escape of the contained fluid, in a case of swollen optic disk. Under iodides and mercury no improvement had taken place, but the symptoms rapidly grew worse. Vision was already seriously threatened. The operation was preceded by a division of the external rectus, and the sheath of the optic nerve was exposed by rotating the eye inward, and the incision made. There was immediate relief from headache. In ten days the swelling of the optic disk had become reduced by one-half, and the recovery was uninterrupted.

The case, he thought, goes far to prove that the pathology of swollen optic disk is primarily dropsical, and only secondarily neuritic. Dr. Carter argued that there was a descent of fluid from the subarachnoid space to the space between the dural and pial sheaths of the optic nerve, and from this cause resulted compression of the nerve, and impeded venous circulation.

Readers interested in this question of the etiology of optic neuritis, will find a thorough *résumé* of Deutschman's researches and experiments in relation thereto in the *Ophthalmic Review* for April, 1887. Deutschman makes it clear that the so-called choked disk is not pathologically distinct from other forms of papillitis, and that the inflammatory process in the nerve is generally an ascending, rather than a descending one. The conclusion reached is that papillitis does not depend upon pressure, but results from an irritating fluid passing from the cranial cavity, and arrested at the bulbar end of the optic nerve, producing there an infective action. This conclusion would, therefore, as necessarily demand the surgical procedure above described, as if pressure, instead of being only a subsidiary cause, were in fact the sole cause. In cases, therefore, when loss of vision is threatened from papillitis of any kind, the indication points to immediate incision of the optic nerve sheath and drainage of the dammed-up retrobulbar infecting fluid.

OPHTHALMIA NEONATORUM.

The fifth of DR. C. BELL TAYLOR'S clinical lectures on diseases of the eye (*Lancet*, April 16, 1887) is devoted to ophthalmia neonatorum, and is a succinct account of the fearful consequences of the common neglect of obstetricians to give but an instant's attention to a simple prophylactic measure.

Of 630 cases treated *in the early stages* by Professors Horner, Schweigger, and Hirschberg, every one recovered with absolutely perfect sight, whilst of 120 cases treated by the same physicians, but *only in the later stages*, 49 became wholly blind. Of the 300,000 blind people in Europe, from one-third to one-half are so from simple neglect of an absolutely certain and well-known precaution.

Credé's method—a two per cent. solution of nitrate of silver dropped into the eyes of *all* newborn infants—should be a public law, neglect of which should debar a physician or midwife for all time. It is an old warning, but it is one that ignored daily produces such a stupendous amount of misery that it seems always *à propos* again to call attention to it.

OTOLOGY.

UNDER THE CHARGE OF

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SARCOMA OF THE CONCHA.

DR. M. D. JONES, of St. Louis (*St. Louis Courier of Medicine*, Feb. 1887), reports the following interesting case of this rare affection:

A negro, aged seventeen, had a lobulated non-pedicellate tumor about the size of a chestnut, springing from the centre of the right concha, filling it and hiding the orifice of the external meatus. The mass looked glossy, and at first was mistaken for a huge polyp protruding from the meatus. The patient stated that two months previously he noticed a pimple on his ear, which itched greatly. He repeatedly scratched it and removed a scab from it, which was followed each time by moderate bleeding. Suddenly the pimple began growing, and in a few weeks attained its large size. At no time was there pain about the auricle. The growth was removed by a cold wire snare, and proved to be a small spindle-celled sarcoma. Fibro-sarcoma of the lobule is not rare and is generally met in the negro. Sarcoma of the auricle, however, is rare, and the case reported here makes the third one where the cancer was found invading the pinna primarily.

ON THE MANAGEMENT OF PERFORATIONS OF THE MEMBRANA TYMPANI.

SIR WM. B. DALBY believes that perforations possess individualities of their own. (*British Med. Journal*, March 12, 1887.) They display an "infinite variety," in their occasional rapid healing, in their tolerance at times of treatment, and again their intolerance and a great susceptibility to climate and diet, especially to stimulants. It is maintained that in all cases of aural discharge, in young children, the membrana is usually perforated. When examined, a few weeks after the discharge has ceased, the perforations will be found to have closed. We must, therefore, "admit that during infant-life the membrane is extremely prone to become perforated, and, happily, equally prone to heal." It is also worthy of note that the majority of these children hear well when they grow up. Although this fortunate ending is often due in part to the fact that there has been no local interference, "it does not follow that nothing should be done for recent infantile perforations of the membrane." They are better, however, without treatment "if such treatment includes mineral astringents in solution." Sulphate of zinc and acetate of lead lotions are worse than useless, as they injure the ear as an acoustic organ, because they "astringe the tympanic end of the Eustachian tube," prevent the expulsion of discharge from the tympanum through the perforation, and permit it to collect and become inspissated. They also cause cicatrization of the edges of the perforation, and interfere, therefore, with the process of repair of the hole in the membrane.

The treatment must consist in scrupulous cleanliness of the middle and external ear, the use of vegetable astringents, and the exclusion of air. This forms the routine treatment under which recent perforations are most likely to heal. The same will apply to recent perforations in adults.

Perforations of long standing and with copious purulent discharge, improve under the use of alcohol instillations of various dilutions. In perforations of small size alcohol generally proves irritating and painful. It is claimed by our author that boric acid and iodoform, though usually acting well, sometimes, in chronic perforations, cause pain in the same side of the head. Our experience with iodoform is limited in comparison with our experience in the use of boric acid; but as both are known to have local anæsthetic properties, it is difficult to see how their use in the ear can cause pain in it, or in the corresponding side of the head. As a matter of fact, we have never seen any such results from their use in the ear, if they are simply insufflated. If they are blown in and then packed down into the fundus of the auditory canal, as is the manner of some, irritation is very apt to ensue.

THERAPEUTIC EFFECT OF IODOL IN SUPPURATION OF THE EAR.

According to Schmidt, iodol possesses the advantage over iodoform in being inodorous, less irritant, and in not exciting any toxic symptoms from its employment on wounds. DR. STETLER, of Königsberg, Russia (*Archiv für Ohrenh.*, Bd. 23, pp. 264–268), has endeavored to substitute iodol for iodoform in the treatment of diseases of the ear, especially in purulent otitis. It has been applied by him by insufflation, after a careful cleansing of the auditory canal, once or twice a day, according to the abundance of the discharge from the ear. The results of his experiments show that iodol has much the same action as iodoform. In the clinic of Schwartze, at Halle, iodol has been tried also. In the same number of the *Archiv f. Ohrenheilkunde*, there is a report of the results obtained there. Iodol being but slightly soluble in water, it has been used according to the plan of Mazzoni, viz., two grammes are dissolved in a mixture of sixteen parts of alcohol and thirty-four parts of glycerine. It has been used chiefly in otorrhœa complicated by caries of the bone. Compresses of gauze, dipped in the above solution, were placed upon the diseased bone, after cleansing, once or twice daily. The results were favorable; both the odor and discharge diminished. The formation of healthy granulations was not hastened by its use. On the whole, it does not seem that iodol has much of a future in otology.

TINNITUS AURIUM, AND ITS TREATMENT BY A NEW METHOD OF ALTERNATE INJECTION AND EVACUATION OF AIR.

Admitting that we know of no specific for the cure of tinnitus aurium, DR. JOHN WARD COUSINS maintains that the removal of this symptom must depend wholly upon the successful treatment of the special morbid process by which it is excited (*British Med. Journal,* March 26, 1887).

In speaking of the treatment of tinnitus dependent upon disease of the middle ear, he says "that theoretically the treatment of this form of tinnitus is a very easy matter, and simply consists in promoting free and healthy communication between the tympanum and the pharynx, and so restoring the normal balance of pressure on both sides of the membrana tympani." Pent-up fluids must be removed, and the mucous membrane stimulated to healthy action. If collapse of the membrana and immobility of the bones exist, our efforts must be directed to promote the normal elasticity of these parts, and reëstablish their intrinsic movements. If the Eustachian tubes are obstructed by secretion, our remedies must be employed for the purpose of clearing the canals, and restoring the normal condition of the nasopharynx and throat.

In the early stages the use of the simple air douche will render good service, but in chronic cases Dr. Cousins prefers "the injection of air and its immediate evacuation. Sometimes the air is medicated by the vapor of some volatile substance, for the purpose of reducing the sensibility of the cavity and stimulating the mucous surface." To accomplish this purpose, an apparatus of his own invention is employed. It consists of two parts: 1. A special nasal piece, for hermetically closing the nose; 2. Two powerful hand-balls, which are connected with the former by an India-rubber tube. The nasal piece is composed of two tubes, with their extremities inclosed in inflatable bags made of very thin and soft rubber. The inflating tube has a separate connection with the lower part of each bag. The hand-balls are fitted with recoil springs, which impart force and rapidity to their expansion. One hand-ball is marked for injection, the other for evacuation, and their converse action is obtained by simply reversing the valvular arrangement, so that the outlet valve is fixed to the connecting tube on one side and the inlet valve on the other. The air injected may be medicated by dropping some selected fluid on cotton placed in a conical vulcanite receptacle at the distal end of the injecting tube. The alternate method of inflation is claimed by its author to have many advantages over the ordinary methods of inflation. Sometimes relief is given by one operation—as it is, indeed, sometimes by any method—while numerous operations may be required before relief is obtained in other cases. It is asserted that this method promotes the immediate discharge of pent-up secretion in the pharynx, and aids in establishing the drainage of the tympanum. "In chronic cases the mobility of the bony chain has been long impaired by the morbid condition of the middle ear; but by gentle repeated agitation in both directions, the adhesions between the ossicles are loosened, and their normal oscillation restored, so that sonorous vibrations can be again transmitted from the drum to the fluid within the labyrinth."

ABSCESS IN THE BRAIN RESULTING FROM DISEASE OF THE EAR.

Dr. Thomas Barr, of Glasgow, has contributed a most interesting and valuable article on this topic, in the *British Medical Journal* of April 2, 1887.

It is admitted at the outset that where abscess of the brain is not caused by an injury, it depends usually upon some preëxisting purulent centre, and this is most frequently in the ear. This is most usually in the middle ear, and it is held that the published accounts of internal ear inflammation, as the source of cerebral abscess, are erroneous. The nature of this disease is a chronic purulent inflammation in the lining membrane of the tympanic cavity, mastoid antrum, and mastoid cells. While there is a general consensus of opinion that ear-disease is the most frequent cause of cerebral abscess, Dr. Barr tries to show, successfully we think, that it is more frequently the cause than is even supposed. In a synoptical record of 76 cases (Sir William Gull and Dr.

Sutton, in Reynolds's *System of Medicine*, 1872), 27 cases, or more than one-third, were set down as due to ear disease. Lebest (*Virchow's Archiv*, 1856, vol. x.) gives 1 in 4 as the proportion, based upon 80 cases of cerebral abscess. But in many cases not attributed to the ear, given by these authors, Barr claims that the ear evidently had not been examined, "while in a goodly number the disease was said to have originated in a blow, which may be quite compatible with its real origin in ear disease." In 10 of the cases in the article in Reynolds's *System of Medicine*, no reason is given for the cerebral abscess. "We know that up to the time at which these articles were prepared, the hearing organ was very little examined, either in the clinical wards or in the post-mortem room." Coupled with the fact that purulent disease in the ear may exist without the knowledge of the friends of the patient, or of even the patient himself, Dr. Barr believes we are not in a position to state that 47 cases in these 156 of cerebral abscess are all that were due to chronic purulent disease of the ear. He thinks that from what is now known, that fully one-half of all cases of cerebral abscess are due to purulent disease of the ear. "As medical men come to use the ear-speculum in every case presenting symptoms of cerebral disturbance, the frequency with which ear disease leads to a fatal issue will be found to be greater than has hitherto been suspected."

The most frequent situation of the abscess seems to be in the temporo-sphenoidal lobe of the cerebrum. In 76 cases tabulated by Dr. Barr, 55 cases, or 73 per cent., were in the so-called middle lobe of the brain; 13 were in the cerebellum; in the cerebrum and cerebellum, 4; in the pons Varolii, 2; and in the crus cerebelli, 1. The disease is propagated from the ear to the interior of the cranium by two ways: 1. Most frequently by the roof of the tympanum and mastoid antrum; 2. By the inner wall of the antrum and mastoid cells to the dura mater lining the posterior fossa, and to the cerebellum. In some rare instances pus makes its way from a cerebral abscess into the middle ear, probably through the tegmen tympani. The "otorrhœa cerebralis," however, of ancient writers cannot be accepted, since the ear disease and not the cerebral disease is the primary affection. Opening the cranial wall by means of chiselling is regarded as productive of concussion to a brain already very sensitive by disease.

"It is quite clear that, in the future, persons suffering from abscess of the brain dependent upon ear disease should not be left to die as they have been in the past, without an effort being made, by opening the interior of the cranium, to reach the brain and drain the abscess. How this can be best done cannot be fully settled until further experience has been gained."

The concluding remark as to prevention is worthy of attention. "When every member of our profession is sufficiently impressed with the importance of chronic suppurative inflammation of the middle ear, and prepared efficiently to treat this disease in all its stages, the occasion for this operation will probably seldom arise."

A Case of Abscess of the Temporo-sphenoidal Lobe of the Brain, due to Otitis Media, successfully Treated by Trephining and Drainage.

The above named case occurred in University College Hospital, under the care of Dr. W. R. Gowers, and to which he called Mr. Arthur E. Baker, F.R.C.S., for surgical aid. (*British Medical Journal*, Dec. 11, 1886.)

The patient was a man nineteen years old. In all respects his health had been good until 1875, when he had scarlatina, which left him with a discharge of thin, yellowish fluid from the right ear. In August last (1886) he suddenly began to feel unwell and complained of pain behind and around the right ear. In the course of ten days he took to his bed, his temperature running up to 105° F. The next day the temperature fell to 103° F., then to 99.4° F., without constipation or diarrhœa. At the time of his admission to the hospital there was no impairment of the nervous system. There was, however, double optic neuritis, slight, but unequivocal. The hearing, taste, and smell are said to have been normal. [The hearing in the right ear must have been somewhat affected after a chronic disease of over ten years.—Reporter.] There was a fetid discharge from the right ear. Urine healthy. Evening temperature 101° F. The next day temperature as low as 96° F. and pulse 52. On the fifth day after admission, Mr. Barker examined the ear and found a large perforation in the right membrana tympani, in the anterior and upper segment. The middle ear was filled with a thick, fetid purulent débris. There was no sign of acute inflammation or tenderness about the ear, or mastoid region.

From the morning of the sixth day after admission, the temperature fell steadily to 97.6° F., on the morning of the eighth day. It varied then between this and 98.8° for a week more. The optic neuritis increased, and the patient grew dull. He had severe vomiting without previous nausea, and his temperature sank to 97.6° F. His pupils were now observed to be unequal, the right being more contracted and sluggish than the left. No headache and no squint. The optic neuritis more marked. On September 27th, twelve days after admission to the hospital, the symptoms were more aggravated, but the temperature remained 98° F. throughout the day. The next day, Mr. Barker decided to open the mastoid antrum and middle ear and search for pus in the latter, and wash it out and drain it, if pus were present. "This was done in the usual way with a gouge, at a point about half an inch above and behind the centre of the external auditory meatus. On opening the antrum there was no gush of pus, but some came away on the instrument; on injecting the meatus, a quantity of curdy and very fetid material was forced out of the opening in the bone; and on inserting a syringe into the latter, similar matter welled out of the meatus. Having then thoroughly washed out the middle ear with carbolic lotion, the whole area of operation was dusted with iodoform and dressed with salicylic wool, a drainage tube being left in the opening."

The next day the patient was decidedly better, though still slightly drowsy; the right pupil did not dilate as fully as the left. Temperature 98.4° to 99° F. Wound dressed with boric acid fomentations, and drained well. The next day the patient felt better and was brighter. There was no pain. "The pupils, however, remained the same, and the optic neuritis was steadily increasing." Temperature 98.6° F.

On the third day after the operation a silver drainage tube was substituted for the rubber one, in the mastoid opening. On the next day, the patient was not so well, having had a restless night. There was no pain, but the patient vomited in the morning. Bowels confined; drowsy. Temperature 98.8° to 97.8° F. On the third day the patient was still drowsier, having been slightly delirious during the previous night. He also vomited, but had neither headache nor squint. On the fourth day he felt drowsy, and on the next day more so. Temperature was normal. While the ear was being syringed there was well-marked nystagmus to the left, in both eyes, which ceased immediately on discontinuance of syringing. In the evening the temperature rose to 105° F., and the patient had a rigor lasting forty-five minutes. The rigor and the intense optic neuritis, in connection with the negative result of the previous exploration, were held to indicate the presence of a cerebral abscess, and Mr. Barker was asked to trephine and search for one in the temporo-sphenoidal lobe. This was done on the same evening. In the first place, the auditory canal, the mastoid wound, and the middle ear were washed out with a solution of carbolic acid (1 to 20) and then dusted with iodoform. A V-shaped incision was made by joining the incision previously made over the mastoid by one running from behind and above, downward and forward. Beneath this flap the bone was found to be healthy. A spot was then chosen for the pin of the trephine, an inch and a quarter behind, and an inch and a quarter above the centre of the meatus of the auditory canal. The region of the foramen of the mastoid vein was thoroughly examined and found normal. This point is always examined by Mr. Barker before opening the skull in cases of intracranial suppuration, because it is claimed that "if there be inflammation on the posterior aspect of the petrous bone, it can hardly reach the cerebellum without forming a layer of pus under the dura mater of the lateral sinus. If this is so, the pus will escape by the mastoid foramen, if the latter be exposed."

The trephine was then used at a point corresponding to the inferior posterior angle of the parietal bone, close to the squamosal suture. The dura mater was found to be quite normal. The membrane was then divided with a knife and turned back, when the surface of the brain was seen to be unaffected, nor was there any fluid in the arachnoid space.

The whole wound and the opening made by the trephine having been again thoroughly washed by a strong solution of carbolic acid and dusted with iodoform, Mr. Barker thrust a hollow aspirator-needle, about the size of a No. 4 catheter, into the temporo-sphenoidal lobe, in a direction inward, forward, and downward. This was done slowly, and when the point had reached a spot about half an inch inward from the surface of the brain, a bubbling sound was heard, followed by thick, yellow, intensely fetid pus, to the extent of four and a half drachms. No more pus escaping through the needle, the cortical wound was slightly dilated, and two or three drachms of pus escaped. The entire area of the wound was then washed and dusted with iodoform, as before, and a rubber drainage tube, two inches long, also dusted with iodoform, was inserted for an inch of its length into the abscess. The V-shaped flap was cut away at its base, so as to leave the trephine hole free for drainage. In a fortnight after the operation, the drainage tube was left out of the wound and the patient allowed to get up. On the third day after the operation a silver tube was substituted for the rubber tube, the latter not staying well in place. The optic neuritis was now greatly improved and disappeared entirely in about three or four weeks after the operation.

In thirty-eight days after the trephining (Nov. 25th), the patient left the hospital looking and feeling very well. There was still some purulent discharge from the affected ear.

By December 4, a month later, both wounds behind the ear had healed, and there was only a slight moisture in the fundus of the right ear. There are other data contained in this article most worthy of perusal by those further interested in such an operation.

ON THE SURGICAL TREATMENT OF BRAIN SUPPURATION FOLLOWING EAR DISEASE.

In an article with this title, "the brain-complications which, while possible with an intact membrana tympani, are commonly associated with long-continued purulent discharges from the middle ear, with generally mastoid involvement," are considered by DR. R. F. WEIR, in the New York *Medical Record* of April 9, 1887. In a case of chronic purulent disease of the ear, in a woman, thirty-nine years old, in which the mastoid was operated on, the subsequent cerebral symptoms pointed toward an abscess in the brain. Therefore, the original mastoid perforation was enlarged for half an inch (it had been made just where the mastoid glides into the external canal), and deepened, until the dura mater was exposed nearly the size of a finger nail. Cutting through this membrane, a hypodermatic needle was introduced to a depth of nearly an inch and a half, being directed along the upper part of the petrous bone, and also into the cerebral lobe in this region, but nothing but a little blood was extracted. No result was obtained by this operation. Eleven days afterward the patient became hemiplegic on the side of the affected ear, with a temperature of 103°, an irregular pulse of 68, and there was vomiting. Under these discouraging circumstances a further ineffectual attempt was made to relieve the patient. With a one-inch trephine a button of bone was removed over the left Rolanderic line, and the dura mater incised crucially, and about two ounces of clear cerebro-spinal fluid were let out. Six exploratory punctures were then made with an aspirator, but nothing was detected. The patient was not bettered, but died next day, comatose. An autopsy was refused.

Dr. Weir states that the situation of an abscess in the brain depends to some extent upon the route by which the inflammation extends from the ear cavities, "the condition of long-tarrying pus, however, being by far the most important of all factors in the self-infection." The important surgical fact, however, comes out strongly, from numerous observations of others, that a majority of the purulent depots in the brain from ear disease are encountered in the temporo-sphenoidal lobe, and that after this the most affected locality is the cerebellum. It should also be borne in mind that both of these regions are fortunately of less value to life, and can better tolerate surgical interference, than almost any other portions of the brain. "It is to the fact of their slight motor importance that our power of localizing tumors and abscesses in these regions is so poor, and this consideration leads directly to the remark that the earliest decided evidences of brain-pressure in the disease under question should be acted upon as soon as detected, since their development presupposes an already large accumulation of pus." Surgical interference with the brain is therefore advised, as soon as a mastoid operation has shown itself to be impotent to relieve the symptoms. In this connection it is well to recall the fact that one-fifth of the cases of cerebral abscess die unrelieved by the mastoid operation. The relief sometimes observed after a mastoid operation, either with or without finding pus, is explained by the supposition that either the cerebral abscess itself has been drained by the operation, or, what is more likely, that an extra-dural collection of matter has been let out by the mastoid opening. In view of these considerations, Dr. Weir believes that, anatomically and surgically, no reasons exist adverse to an early opening of the dura and draining the fossa in cases of suppurative meningitis of the middle fossa due to aural disease. When symptoms are present by which the probable site of the purulent collection can be located, whether in the temporo-sphenoidal lobe or in the cerebellum, the surgeon will be guided largely by the neurologist. The cerebellar region is not regarded as inaccessible to surgical treatment, and therefore the advice is given that if the cerebral abscess can be excluded in favor of an abscess in the cerebellum, there should be no hesitation in operating below the tentorium through the occiput. The guide in operating on the cerebellum, given by Mr. Barker,[1] should be remembered, viz., to expose the opening of the mastoid vein, where, if pus has spread backward to the cerebellum from the ear, some of the discharge will be found oozing from beneath the dura, at this opening in the masto-occipital region. Much of a minute and specific nature is given in this paper by Dr. Weir, and should be carefully read by all contemplating an operation for the relief of an abscess in the brain.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF

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DIPHTHERIA.

To favor syringing the nasal passages, **REIERSON**, of Copenhagen, passes medicated bougies which melt in an hour, and reëstablish the patency of the passage. For large children and adults they are 3¼ inches in length and ⅕th of an inch in diameter. The formula is cocaine hydrochlorate ⅙–⅕th grain, boric acid 15 grains, starch and powdered acacia each 1½ grains, and glycerine sufficient. For younger children the bougies are shorter, and contain ½ grain of the cocaine, or less, and 10 grains of the boric acid. The bougies should be stiff, and be pointed at one end. One is introduced into each inferior meatus. They should reach as far as the nasopharynx.—*Journal of Laryngology*, Jan. 1887.

INTUBATION OF THE LARYNX.

DR. A. CAILLÉ, of New York, reports (*Medical Record*, March 19, 1887) a successful case in a child five years of age, with diphtheritic laryngeal stenosis. Attention is called to a Dr. Denhard's important modification of the gag, but this is not described.

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[1] Alluded to already in this report.

EARLY TRACHEOTOMY IN DIPHTHERIA.

MR. W. WATSON CHEYNE (*Brit. Med. Journ.*, March 5, 1887) believes that the indication ought not to be obstruction to the respiration, but that tracheotomy ought to be performed in cases of diphtheria as soon as it is certain that the larynx is affected; and chiefly with the view of preventing the spread of the membrane downward. This he claims to do by inspecting the incised trachea, removing any semblance of membrane if present, and, membrane or no membrane, applying a 1 in 500 solution of bichloride of mercury.

LUPUS OF THE NOSE AND RHINOLITHS.

DR. L. V. SILITCH, of St. Petersburg (*Vratch*, No. 1, 1887), reports two instances of calculi removed from patients with lupus of the nose.

MUCOUS POLYPI IN THE RIGHT ANTRUM.

DR. SHAEFFER (*Monatschrift für Ohrenheilkunde*, etc., 1886, No. 11) describes an instance in a female, fifty-nine years of age, for sixteen years the subject of nasal polypi. Eight or ten dense, small polypi were removed by scraping the antrum with a sharp spoon, access being through the socket of the second molar. At the date of the report severe neuralgic pains, supraorbital, infraorbital, and alveolar, had continued relieved for four months.

CYST OF THE NASAL MUCOUS MEMBRANE.

SCHAEFFER (*Monats. f. Ohrenheil.*, 1886, No. 11) reports a cyst the size of a walnut, involving the anterior portion of the lower right turbinate body and the floor of the nose of a woman, fifty-four years of age. It was opened by a large incision made upward behind the upper lip, and discharged a tablespoonful of albuminous fluid, with a few flakes of pus. The cavity was cauterized with chromic acid, and a drainage tube inserted. Contraction of the cavity necessitated removal of the tube the next day. Recovery was complete in eight days.

NASAL AND NASOPHARYNGEAL REFLEX NEUROSES.

DR. P. MCBRIDE, of Edinburgh, in a lecture reported in *The British Medical Journal* of January 29, 1887, traces the recent history of the literature on this subject, coming, among other conclusions, to the following: That application of the actual cautery to the nasopharyngeal mucosa is no less effective than cauterization of other parts which has been known to cure such neuroses, and may be more so; that we have no means of knowing, in any given case, whether it can be cured by treatment to the nose; that weakness of voice accompanying granular pharyngitis may be purely reflex, and that electricity to the larynx may be indicated rather than destruction of the granulations. A tolerably complete bibliographic index is appended.

STRICTURE OF THE ŒSOPHAGUS.

In a female forty-nine years of age, whose symptoms had been those of chronic gastritis with emesis, the œsophagus, for nearly its entire length, was found by **DR. J. W. ROOSEVELT**, dilated to about the bulk of a quart. (*Medical Record*, March 12, 1887.)

In an article on the treatment of malignant stricture of the œsophagus by tubage or permanent catheterism, by **MR. CHARTER J. SYMONDS** (*Brit. Med. Journ.*, April 23, 1887), he reports four personal observations, having had eight cases under prolonged treatment. He prefers dilatation with bougies so long as solids can be swallowed; then the use of a short rubber tube, removed from time to time, until fluids can no longer be taken; and then resort to Krishaber's long tube, or to gastrostomy.

PULSATING ARTERIES OF THE PHARYNX.

DR. J. W. FARLOW, of Boston, presents (*Journal Amer. Med. Assoc.*, April 2, 1887) a record of five cases of large visible pulsating artery on the posterior wall of the pharynx, with remarks. All five were in females, the ages being four, thirteen, eighteen, twenty-three, and thirty years.

LARYNGECTOMY.

MR. LENNOX BROWNE, of London, has reported (*Brit. Med. Times*, February 5, 1887) a successful case of partial excision of the larynx, on account of intra-laryngeal epithelioma in a man sixty-one years of age. One-half of the larynx was removed.

DR. D. HAYES AGNEW, of Philadelphia, reports (*Med. News*, April 9, 1887) a case of total extirpation for epithelioma. Death ensued on the second day from exhaustion.

Extirpation of the larynx for carcinoma was performed by **DR. J. H. BRANHAM**, of Baltimore, on January 20th (*Maryland Med. Journal*, February 5, 1887, p. 356). Death ensued within thirty-six hours from "aspirating" pneumonia. In this case, as in Agnew's, unsuspected infiltration of the œsophagus was revealed during the operation.

DR. W. GARDNER, of Aldelaide, South Australia, reports (*Lancet*, May 7, 1887) a case of excision of the epitheliomatous larynx in a male, aged sixty. Three months later the disease had reappeared.

FIBROSARCOMA OF THE NASAL SEPTUM.

MM. CALMETTES and **CHATELLIER** report (*Annales des maladies de l'oreille du larynx*, etc., Mars, 1887) a case in a married woman, thirty years of age, successfully removed by operation with the incandescent electric loop. Eleven months later there had been no recurrence.

BLACK TONGUE.

DR. PH. SHECH, of Munich (*Münchener med. Woch.*, No. 13, 1887), reports a case in which he examined microscopically a portion of the product cut as close to the base as possible. He found it composed of excessively elongated, pigmented, and fully cornified filiform papillæ, but failed to find the special mycophites described by some observers. He concludes that the black tongue belongs to the category of hypertrophic, and not of mycotic, diseases.

PHARYNGITIS SICCA.

DR. E. J. MOURE, of Bordeaux, recommends (*Revue mensuelle de laryngologie*, etc., Avril, 1887), among other treatments, pencillings with a mixture of tincture of capsicum, one part in fifty to one hundred of glycerine.

LARYNGEAL MEASUREMENTS.

DR. MOURA, of Paris, concludes in the April number of the *Revue mensuelle de laryngologie*, etc., his exhaustive and laborious series of measurements of the various laryngeal structures in males and females in his critical studies of the anatomico-physiological conditions of the human voice. A series of tables presents the statistical records of the observations described at length in the text.

ATROPHIC RHINITIS.

DR. NOQUET, of Lille, in some considerations on this theme (*Revue mens. de lareto*, Mai, 1887), claims to cure the disease in many instances, even to regeneration of the atrophied tissues. He uses Weber's douche twice a day, with a tablespoonful of potassium chlorate to the litre of tepid water, followed by pulverization of a solution composed of chloral hydrate, 1 part; boric acid, 12; glycerine, 20; distilled cherry-laurel water, 40; and distilled water, 400 parts. In the middle of the day an additional pulverization is practised with water aromatized with antiseptic vinegar, in the proportion of about one to fifty. After eight days carbolic acid replaces the potassium chloride, in the proportion of about two grammes to the litre. In addition, pencillings are made by the attendant with a solution of zinc chloride (20 : 100?), rendered limpid by the addition of a small quantity of chlorohydric acid.

DERMATOLOGY.

UNDER THE CHARGE OF

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PROFESSOR OF DERMATOLOGY IN THE UNIVERSITY OF PENNSYLVANIA.

AND

HENRY W. STELWAGON, M.D.,

PHYSICIAN TO THE PHILADELPHIA DISPENSARY FOR SKIN DISEASES.

ICHTHYOL.

ELLIOT contributes (*Medical Record*, March 19, 1887) a comprehensive paper on his experience with ichthyol in the treatment of cutaneous diseases. He finds that the two ichthyol preparations—ammonium ichthyol and natrium ichthyol—differ in their action, often considerably. As a rule, better results are to be obtained by the soda preparation. In cases of simple acne, acute or subacute in type, the natrium compound was without result. It was given internally in doses of four to eight grains three times daily; the ammonium compound gave the same negative results. In acne indurata the natrium ichthyol was also useless, but the ammonium preparation rendered good service. It was applied as a five to eight per cent. solution. Deep-seated, indolent, lumpy lesions were arrested in their development and rapidly disappeared. In spite of its prolonged use and administration, however, new lesions continued to make their appearance. It proved valuable, also, in those cases of acne of the chin in women, usually so obstinate to treatment.

In the treatment of rosacea the results were unsatisfactory. In some cases of eczema its local application appeared useful, but the internal administration of the remedy had no apparent effect, either on the immediate attack or in preventing relapses. In chronic eczema rubrum, especially when on the legs, and depending upon varicose veins, excellent results were obtained by the use of the natrium ichthyol; the ammonium preparation, even in weak percentages, gave rise to pain, burning, and an increase in the inflammatory symptoms. More especially were the favorable effects of the soda compound (three to five per cent. aqueous solution) seen in its keratoplastic action, in this class of cases associated with ulcerations. In seborrhœa oleosa about the nose, the ammonium compound gave good results, if used alternately with other plans of treatment. In intertrigo the natrium ichthyol proved serviceable; the ammonium salt was less valuable. It was used in ointment form, two to ten per cent. strength.

In dermatitis these preparations were also useful. The same good effects in burns of the first and second degree were seen to follow applications of a five per cent. aqueous solution of the natrium salt. In chronic urticaria the administration of the ichthyol salts seemed without value. The same may be said as regards ichthyosis, used both externally and internally. In the after-treatment of lupus, following the use of the nitrate of silver or the curette, an ointment of the natrium compound, five per cent. strength, induced rapid healing. The effect of a five per cent. ointment of the ammonium ichthyol on cicatrices was of a satisfactory character; the parts were rendered more pliable, and also a decrease in size often following.

While admitting the value of the ichthyol preparations in certain diseases of the skin, the author, from his experience, cannot consider them entitled to the therapeutic importance claimed by Unna, Küssner, and other German observers.

UNNA, in a brief note in the *British Medical Journal* of April 9, 1887, reaffirms his opinion as to the value of ichthyol, administered internally, in acne rosacea, nervous forms of eczema in persons of nervous constitution, eczema from teething, lichen urticatus, erythema multiforme, dermatitis herpetiformis, and furunculosis. It is not indicated in psoriasis. After five years' experience with the remedy, Unna states that it is also valuable in acute and chronic rheumatism, bronchial asthma, chronic catarrh of the stomach and intestines, together with catarrh of bile duct (icterus), chlorosis, tuberculosis (especially in children), scrofula, and in vascular engorgements of all kinds. [The dose of ichthyol varies from three to fifteen grains three times daily, preferably administered in capsules.—EDS.]

AMENORRHŒA, SEPTICÆMIA, AND DERMATITIS MULTIFORMIS.

DR. H. F. KERR (*Virginia Med. Monthly*, January, 1887) reports a case of amenorrhœa, followed by septicæmia, a multiform dermatitis, and death, occurring in a previously healthy girl seventeen years of age. A cold was contracted, the result of dancing and over-heating, after which menstruation ceased, and various general symptoms set in. Three months later, swelling, having a purpuric aspect, occurred about the face, hands, forearms, and feet, followed soon by numerous distended blebs of the size of large split peas, round and oval in form, containing a clear fluid. Intermingled with the blebs were small, pin-head sized pustules, containing pus of a whitish color. There were itching and burning. In a few days the blebs became covered with yellowish, and later, brownish crusts. The face and forearms were the seat of a thick, adherent mass of crusting, beneath which the skin showed an oily, smegma-like, cheesy product, which, when removed, displayed a bluish sensitive skin. In other regions, as the neck and elbows, the crusts were soft and fatty, and there existed deep and painful fissures. On the flexor surfaces of the arms, hands, and feet, especially, and to some extent over the whole surface, the skin had the consistence and appearance of old leather, being thickened and sclerosed. Later, desquamation occurred in the form of exfoliation, the skin of the fingers and toes coming off like casts. In certain regions, as on the body and the legs, the eruption manifested a squamous type. The temperature and pulse were both above normal. The treatment was expectant. The patient died. Two weeks before death a whitish, jelly-like, odorless discharge took place from the vagina. Previous to this, an examination of the uterus gave no cause for the menstrual suppression.

Dr. Kerr is of the opinion that septicæmia existed as the result of suppression of the menses and absorption of septic matter, and that the cutaneous symptoms, although different in some respects, bear more relation to Duhring's dermatitis herpetiformis than to any other disease.

IMPETIGO HERPETIFORMIS.

KAPOSI (*Viertelj. für Derm. u. Syph.*, 2 Heft, 1 Hälfte, 1887) is of the opinion that the term impetigo herpetiformis, proposed and employed by Hebra, in 1872, to define a rare and peculiar disease of the skin, should be retained for this affection, of which he has seen thirteen examples. Hebra's observations led him to think that the disease was peculiar to women, and who were either pregnant or were in the puerperal state, a view which has likewise been entertained by Kaposi until now. He has recently seen a case occurring in a man. All of the cases, except one, proved fatal. The paper is illustrated with four handsome chromo-lithographs, several of which are reproductions from Hebra's atlas. The author regards some of the reported cases of impetigo herpetiformis (as those of Heitzman and of Pataky) as examples rather of pemphigus and herpes iris, than of the disease under consideration. He also takes exception to viewing impetigo herpetiformis as a variety of dermatitis herpetiformis, as proposed by Duhring.

Impetigo, it is stated, signifies pustules—that is, efflorescences filled with pus; while herpetiformis, as this term was originally employed by Hebra, conveys merely the idea that the lesions are arranged as in "herpes"—that is, in groups and streaks or bands (streifen), and that the eruption, just as in "herpes," spreads peripherally after undergoing central involution. It would have been better, perhaps, the author thinks, to designate the disease "impetigo circinata et iris," in which case the term herpes would not have appeared in connection with this subject. Herpes has nothing in common with impetigo, the former being defined as an acute affection characterized by *vesicles* (*i. e.*, efflorescences filled with clear, translucent serum), which only in the course of hours or days became cloudy or pustular, together with the appearance of other signs of involution. In impetigo there exist from the beginning pustular vesicles (*eiterhältige Bläschen*), and always only such during the entire course of the disease.

Impetigo herpetiformis is characterized, 1st, by miliary, existing primarily as such, superficial—*i. e.*, *epidermoidal*—pustules; 2d, these, throughout their entire course, manifest the same features; 3d, they are always arranged in groups and aggregations; and, 4th, the lesions appear afresh on the border of older patches, in the form of one or more series, upon inflamed bases, while in the centre involution occurs, but in no case ulceration and scarring. Other essential characters of the disease are found in the exclusive occurrence in pregnant or puerperal women [the case of the author, occurring in a man, is reported later in the article.—Eds.]; the accompanying chills and marked fever; preference of the eruption for certain localities, as the genito-crural region, mammæ, and mucous membrane of the mouth; and finally, with one exception, the fatal termination of the disease. The author inclines to the view of the process being pyæmic.

Two Epidemics of Molluscum Contagiosum.

Dr. W. F. Mittendorf, of New York (*Trans. Amer. Oph. Soc.*, 1886), thinks, from his observations in two epidemics of this affection, that there is very little doubt in regard to its contagiousness. The disease occurred in two distinct homes for children on Staten Island. A little girl was admitted to one institution with one or two small "warts" on the eyelids: within a few weeks several of the other girls had the same growths appear on the eyelids, lips, and nose. Three months after the admission of the first case, twenty-seven children, nearly all of them girls, were affected, the lesions in every instance involving the eyelids, and in some other parts of the face, but in no case was the rest of the body invaded.

In the other institution the first case was observed two years ago, and at date of writing, forty-one children were affected, as well as one of the nurses and her child, who lived outside of the nursery. Some of the children were given out to a farmer who boarded them. In a short time the disease had spread to several of the children boarding at this farmer's place, to the child of the farmer, and likewise to his wife, disfiguring her greatly. In a number of instances the tumors, varying in size from a mustard seed to that of a pea, had spread to other parts of the face, but they were usually confined to or more marked about the lids, some being located at the free edge of the lid and among the eyelashes. Three cases of spontaneous cure were noted.

In regard to the treatment, it was found that abscission with curved scissors and touching the base with stick of nitrate of silver was most satisfactory.

MERCK'S CONCENTRATED LACTIC ACID; SOME OF ITS USES IN DERMATOLOGY.

In the *Journal of Cutaneous and Genito-Urinary Diseases* (April, 1887) KNOCHE relates his experience with lactic acid in the treatment of tylosis, chloasma, freckles, and warts. In tylosis the acid was applied pure, being well rubbed in. The epidermic masses were soon softened, and easily peeled off, this result following a few days' treatment. The affection tended to recur, but finally, under this treatment, disappeared. In a case of chloasma, the acid was applied diluted with three parts of water; after the second application the surface became slightly inflamed. The inflammation soon subsided, and the epidermis began to peel off in spots. Upon a repetition of the treatment the discoloration was entirely removed. A case of freckles was treated in the same manner with satisfactory results. In the treatment of warts also the author had success; the free acid was applied, by means of a pointed stick, two or three times daily for several days.

THE CUTANEOUS PUNCH.

KEYES describes (*Journal of Cutaneous and Genito-Urinary Diseases*, March, 1887) a small punch or trephine which he has employed with success in the removal of powder specks from the skin, in epithelioma, moles, and other blemishes. The instrument is made in several sizes, and has a sharp cutting edge. By pressing it upon the skin and rapidly rotating, a circular piece of skin, corresponding to the size of the instrument used, is cut; this projects, and is snipped off with the scissors. The depth of the cut may be varied according to the amount of pressure made. As an after-dressing the author used chiefly powdered subsulphate of iron. In cases in which the smallest sized punch was used the scarring was scarcely perceptible.

ACTINOMYCOSIS OF THE SKIN.

MAJACCHI (*Monatshefte für prak. Derm.*, No. 7, 1887) was the first to describe a case of actinomycosis of the skin, occurring in a young woman, in 1882 (Rivista clin. di Bologna). A second case is now reported by this observer, in the person of a child, seven years old, the disease being in the neck in the form of two ulcers with scrofulous aspect. Between the granulations were found numerous sulphur-yellow masses, some of which were hard and chalky, and could be readily removed without pain or causing bleeding. Microscopic examination showed a large number of actinomyces surrounded by young granulation tissue. Under the use of mercurial ointment, and later iodoform, the wounds healed in about six weeks, without a return of the disease. The case observed in 1882, manifested itself in an anthracoid form with purulent necrotic products, together with pyogenic microörganisms in addition to the actinomyces, causing septicæmia and the death of the individual.

DERMATITIS VENENATA.

DR. J. S. HOWE (*Bost. Med. and Surg. Journ.*, March 10, 1887) calls attention to the poisonous effects upon the skin of leucanthemum vulgare, known in different localities as white daisy or field daisy, which is plentiful in New England and in the middle Atlantic States. Four cases of severe dermatitis are detailed, the eruption closely resembling in character that resulting from rhus, dogwood, and sumach. It would seem that the inflammation is particularly liable to attack those who are subject to dermatitis from rhus, etc.

CHRONIC ZOSTER.

DR. LEUDET (*Archives Gén. de Méd.*, January, 1887) believes, with Verneuil, that zoster may present itself in several forms; thus, it may be acute, transitory, and without apparent gravity, leaving behind it pains of longer or shorter duration, and disappearing without leaving trace. Another time the eruption may persist over a period of months, and the ulceration which succeeds the vesicles may be deeper, or, after cicatrization sufficiently rapid, the scar may ulcerate anew, and the process repeat itself several times. Sometimes it is limited to the relapses of ulceration. At other times the ulceration is accompanied with redness, swelling, and a neuritic pseudo-phlegmon, as Hamilton has described. Finally, the ulceration may cicatrize and give place to keloid, which may be regarded as a truly chronic zoster.

A second form is that which the author denominates "relapsing zoster *in situ*." A third form is characterized by successive extension upon several branches of the same nerve or upon contiguous nerves. Finally, the fourth form may be called "zoster at a distance," and in these cases the herpetic eruption spreads out upon one or another nerve distant or may be secondary to a lesion of a nerve filament, without apparent anatomical relation to that where the eruption manifests itself. This classification is similar to that put forth by Verneuil, who describes three forms of zoster: 1st. The peripheric or centrifugal; 2d. The traumatic in proximity; 3d. The traumatic at a distance.

Leudet's conclusions (based upon an experience of eighty-five cases, extending over thirty years) are summed up as follows:

1. Zoster, in medical diseases, as in traumatism, may be: *a*, the expression of a local lesion, manifesting itself upon the peripheric branches of an altered nerve; or, *b*, it may make its appearance at a distance in general diseases, calling forth the lesions on the peripheric nerves; or, *c*, it may be chronic *in situ*, relapsing successively upon the nerves and branches in direct anatomical communication with the primitive branch attacked, or upon distant branches; *d*, it may, moreover, be the effect of poisoning, as by carbonic oxide.

2. The anatomical cause is a lesion of the intervertebrate ganglia, of the Gasserian ganglion, and of the peripheric nerves, or of these latter only.

3. Local lesions of the pleura, of the lung, of the spinal column, of the spinal meninges, of the cord, of the brain, are such as have occasioned zoster in the classical observations of Bærensprung, Charcot and Cottard, Chandelux, and others. Chronic pleurisy and tuberculosis of the lung should figure among the most frequent causes of zoster (20 out of 86 cases).

4. Chronic zoster may persist three or even six months. The ulcerations which succeed the vesicles may reproduce themselves, and sometimes terminate in keloid. Each exacerbation of the ulceration may be accompanied with redness and swelling.

5. Frontal zoster may be called forth by an exacerbation of pulmonary tuberculosis, and by the paralytic or convulsive accidents which have been described in empyema.

MIDWIFERY AND GYNECOLOGY.

UNDER THE CHARGE OF

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Complete Inversion of the Puerperal Uterus: Threatened Gangrene, and Cure by Laparotomy.

Schmalfuss records in the *Centralbl. für Gynäk.*, No. 46, 1886, a case of inversion of the uterus after labor. Partial gangrene of the uterine wall was present, and, therefore, abdominal section was performed as Thomas, of New York, has recommended, so that replacement might be brought about with as little force as possible. With careful antiseptic precautions the abdomen was opened and the funnel-shaped portion of the inverted uterus drawn up. The funnel was dilated with the finger and pressure made through the vagina on the fundus by means of a sponge on a sponge-holder. Reinversion was easily performed in this way, the uterus washed out with cold boracic lotion, and the vagina tamponed with iodoform gauze. Recovery was complete.

Defective Sanitation as a Cause of Puerperal Disease.

Playfair, in the *Lancet* of Feb. 5, 1887, draws attention to the fact that sewer gas may cause in puerperal patients attacks of illness indistinguishable clinically from ordinary puerperal septicæmia. The following illustrative cases were given:

Case I.—Temperature 104° for six weeks; pyæmic abscesses two months afterward. The defects in drainage were leaking of soil pipe, leaking brick drains, and defective joints with soaking of sewage. Further, the lady's bedroom, boudoir, and water-closet were continuous. The curious fact is further mentioned that in a favorite professional street in London there have been seven cases of puerperal septicæmia, with two deaths, in five years.

Case II.—Patient had dangerous septic disease, while her husband had also diphtheritic sore throat. The waste pipe of the bath-room, which was close to the bed, opened directly into the main drain, which was thus ventilated into the dressing-room.

Case III.—Lady had well-marked septic symptoms in her second confinement. On examination it was ultimately found that what seemed to be a wardrobe in the bedroom was really a water-closet; it had a special soil pipe carried through the centre of the house and opening directly into the main drain. It was really a costly means of ventilating the main drain into the sleeping apartment.

In all the cases removal from the infected house was followed by good results.

TREATMENT IN CASES OF ABORTION WHERE THE PLACENTA IS RETAINED.

Budin, in a recent lecture delivered at the Academy of Medicine, considers the treatment in cases of abortion where the membranes have been retained; the dangers of such retention are hemorrhage and septicæmia. The ordinarily accepted treatment by immediate removal, either by the finger or curette, he criticises unfavorably, and then proceeds to discuss

1. *Is retention of the placenta really a source of frequent accident?*
2. *Are the digital and instrumental procedures for the removal of the placenta quite inoffensive?*

In 210 cases at the Charité and Maternité the placenta was retained in 46 cases (22 per cent.). When the abortion was complete the mortality was almost nil.

In the incomplete cases the results were good; one patient died from septicæmia. Budin quotes several cases of death or of cellulitis, peritonitis, and endometritis following active removal of the placenta, either manually or by the curette. He recommends, therefore, the vaginal antiseptic plug against serious hemorrhage, and vaginal, or, if necessary, uterine antiseptic douches when septic symptoms arise. The antiseptics recommended are corrosive sublimate 1 : 2000 or 1 : 3000, and carbolic acid 2 : 100 or 3 : 100.

[Budin is so careful and accurate an observer, and one so thoroughly imbued with the principles of antiseptics, that any recommendation from him is worthy of all attention. At the same time I cannot indorse his treatment. In many cases of retained placenta after abortion I have always removed the retained portions at once and douched the uterus with an antiseptic. Where the cervical canal has not been sufficiently dilated I have used Hegar's dilator to complete this. The retained portions can thus be removed bimanually as follows: The patient is chloroformed and placed in the dorsal posture. The right hand is then passed into the vagina and the index finger into the uterus, which is grasped by the left hand so as to steady and fix it. The finger can now easily separate bulky remains, and any shreds can be curetted out. I have never had any result but perfect recovery, with no inflammatory sequelæ.]

THE TREATMENT OF UMBILICAL HERNIA.

Olshausen believes (*Arch. für Gynäk.*, Bd. xxix. Heft 3) that umbilical hernia is fatal unless operated on, despite the statistics of Lindfoles, who records twenty-seven cases of cure by pressure or the ligature. Olshausen, in fifteen cases, has seen no instances of preservation of life unless in operated cases. One child with part of the liver in the sac lived five weeks. When left to nature we usually get destruction of the amnion, tear of the peritoneum and peritonitis, causing death. The following cases of operation are given:

Case 1 *by Breus.* In this case Breus opened the sac, replaced the hernia contents without difficulty, grasped the opening with forceps, and passed strong silk suture below the forceps. The sac was then cut away above the forceps and cauterized. Cure resulted.

Case 2 *by Felsenreich.* The sac was opened, excised, and the abdominal incision sutured by twelve stitches. Union by first intention.

The cases of Lindfoles and Stadfeldt we omit, and pass on to give the one recorded by Olshausen.

The child presented footling, weighed 4280 grammes, and was 57 cm. long. It had a large umbilical hernia and macroglossia. The cord was 96 cm. long, and was tied about 10 cm. from the umbilicus. The opening of the hernia was about 4 cm., and the sac contained intestine. Half an hour after birth there were bullæ and a slight tear of the sac. Three and a half hours afterward the following operation was performed: An oval incision was made close to the skin margin around the internal opening, and then the skin edge and amnion stripped off the parietal peritoneum (sac). The raw edges of the skin were then brought together, the cut vessels being ligatured. In this way the hernia was reduced with the peritoneum intact. The wound healed slowly but soundly. The child died eight months afterward from intestinal catarrh. On post-mortem, the macroglossia was found to be due to connective tissue hyperplasia. There was also non-descent of the ovaries.

Olshausen finally points out that this operation cannot be practised unless the hernia is replaceable.

A Case of Gastrotomy for Extrauterine Gestation in which the Placenta never came away.

Dr. Braithwaite records (*Lond. Obst. Trans.*, 1886) a case where he performed abdominal section for extrauterine gestation. The fœtus was full-grown, had been dead for three weeks, and was lying quite free in the abdominal cavity, except that a fine membrane cut it off from the intestines which lay above it. The placenta covered the top of the uterus, was not removed, and, so far as could be made out, did not come away afterward. When the patient was examined bimanually some time after the operation, no trace of it could be felt, unless as a small ring of dense tissue at the level of about half an inch from the fundus uteri.

Fœtus and Placenta of Extrauterine Gestation removed by Abdominal Section.

Dr. Herman describes (*Lond. Obst. Trans.*, 1886) a case where he removed an extrauterine fœtus by abdominal section. The fœtus lay enclosed and adherent to its membranes, the liquor amnii having been absorbed. The placenta was attached to the anterior abdominal wall, upper surface of bladder, and left broad ligament. Dr. Herman tied and divided muscular adhesions between placenta and omentum, and separated, by tearing, the placenta from the bladder and abdominal wall. The part of the placenta adherent to the broad ligament was treated by tying the latter in two parts, and then cutting away the placenta. In this way the ovary had to be removed.

The fœtus weighed 3 pounds 8 ounces, and was compressed and flattened. The weight of the placenta was 28½ ounces; the cord was shrivelled, and the placenta seemed made up of placental tissue with extravasated blood between the tufts.

A Case of Removal of both Ovaries during Pregnancy.

Mr. Knowsley Thornton (*Lond. Obst. Trans.*) records a case where he removed both ovaries at the fourth month of pregnancy. The operation was performed in the usual manner, the ligatures being placed on the pedicles as far from the uterus as possible. This was done with the intention of avoiding the metrostaxis which usually comes on when both ovaries and tubes are removed, as it might hence set up abortion.

The patient recovered, and was delivered at the eighth month of gestation of a healthy child; the third stage was normal. Lactation was performed satisfactorily, although the uterus was atrophic four months afterward, and the mother had the usual menopause phenomena. The case further shows that the ovaries can have no influence in starting labor.

ON MERCURIALISM IN LYING-IN WOMEN UNDERGOING SUBLIMATE IRRIGATION.

DAKIN, in the *Lond. Obst. Trans.*, 1886, makes a valuable contribution to the question of mercurialism following the use of corrosive sublimate as an antiseptic. As is now well known, Tarnier, in 1882, was the first to use this drug as an antiseptic in puerperal cases. The general outcome of its use has been a great diminution in the mortality and morbility of maternities, a result somewhat clouded by occasional cases of poisoning with even fatal results, as many as eight deaths having been reported. The cases known are as follows:

1. *Stadtfeldt's case.* One intrauterine injection, 1:1500, five days after labor. Death on eleventh day. Kidney and intestinal changes found.

2. *Somer's case.* Vaginal, 1:1000.

3. *Winter's case.* Intrauterine douche, 1:1000; vaginal afterward of 1:1000. Death on fourth day. Post-mortem, gangrenous colitis and peritoneal exudation.

4. *Vöhtz.* Intrauterine injection, 1:750, after abortion. Death on eleventh day after intestinal and kidney symptoms.

5. *Partridge.* Two intrauterine injections, 1:2000; dysenteric symptoms and death.

6 and 7. *Thorn.* Intrauterine douche after missed abortion, 1:1000; vaginal douche, 1:1000 in forceps case. Renal and intestinal lesions.

8. *Ziegenspeck.* Death on thirteenth day after three injections of 1:5000. No bad symptoms until second intrauterine douche on eighth day; patient died five days afterward.

9. *Netzel.* Intrauterine douche, 1:1500, on seventh day; abdominal pain then complained of; renal symptoms with albumen and lime salts in urine. Death on twenty-second day.

10. *Gustav Braun.* Douche during first stage; episiotomy performed during second stage, and intrauterine irrigation, 1:1000, after expulsion of placenta. Diarrhœa on third, and collapse on seventh day.

11. *Hofmeier.* One douche of 1:1000. Death on sixth day.

In all cases of douching Keller found mercury in urine, and also albumen.

Dakin then gives the results of the use of sublimate irrigation in 170 patients confined in the General Lying-in Hospital, London, under the charge of Dr. William P. Champneys. The sublimate is used as follows: Hands and instruments are disinfected with 1:1000; the vagina is douched after labor with 1:2000, two pints, at a temperature of 115°–120° F., being used. For the first two days three pints of 1 : 2000 at 110° F. are employed, and then the strength is reduced to 1 : 4000. The patient occupies the dorsal posture, and after the douche is finished turns on her hands and knees, to evacuate any residuum.

Symptoms of poisoning usually appeared between the fourth and seventh days, and were usually diarrhœa, with blood and tenesmus, sometimes vomiting, patchy tongue, thirst and loss of appetite, fetor of breath, salivation with tenderness of teeth and gums, as well as red line on gums. The urine contained albumen in 11 of the cases.

Details of the one fatal case are given, with examination of kidneys.

He comes to the conclusion that a strength of 1 : 4000 is sufficient for douching.

Castration in Neuroses.

Schröder (*Zeitschrift für Geb. und Gynäk.*, Bd. xiii. Hft. 2) first points out that his disagreement with the views of Hegar in this question is only partial. With Hegar, he agrees in separating the cases where one removes diseased ovaries from those where the ovaries are removed to bring on the menopause. In the first class of cases the indications present no difficulty. No one can dispute that it is right to remove ovaries when diseased. The only point on which opinions can differ is as to whether the disease is severe enough to demand extirpation. This class, of course, includes ordinary ovariotomies, but one has as much right to remove a chronically inflamed ovary when dangerous to life or causing pelvic inflammatory mischief. When one ovary is thus affected, it alone should be removed; and it may be possible to remove only part of it. Schröder would, with Martin, include these with ovariotomy cases, thus separating them from castration.

The second class is quite different, as one must remove both ovaries completely; not because they are diseased, but to bring on the menopause. Schröder further points out that the effect of the removal of the ovaries or fibroids must be settled by experience, and criticises the view that neuroses are associated with pathological changes in the ovaries. Hegar admits that the nervous disturbance does not in any way agree with the severity of the pathological changes, but Schröder goes further, and alleges that the hitherto demonstrated changes, either clinical or anatomical, have nothing to do with general neuroses.

Schröder next points out the difficulty of diagnosticating minor changes in the ovaries, even with Schultze's method, and alleges (quite truly) that our knowledge of the pathological anatomy of the ovary, apart from tumor formation, is practically a blank, and that there is, therefore, entirely wanting a scientific basis for castration so far as the pathological changes in the ovary are concerned. Schröder has performed castration for neuroses ten times, but gives the result in only four, where the time since operation has been long enough to enable one to judge. He points out here that the immediate effect may be good, but that ultimately a relapse to the old condition takes place. The results in the four cases were good; no special pathological changes were found in the ovaries removed.

A CASE OF CURED PERITONEAL TUBERCULOSIS.

POTEN (*Centr. für Gynäk.*, Jan. 15, 1887) first draws attention to Hegar's monograph on genital tuberculosis, and to the statements in it as to the cure or arrest of diffuse miliary tubercle of the peritoneum by laparotomy. He points out that it must be shown in each case that the affection is really miliary tubercle, and not a granulating affection of some other sort. This can only be settled, of course, by the discovery of miliary tubercle and the bacillus tuberculosis on microscopic examination.

König, in some cases of peritoneal tuberculosis, treated with carbolic acid and iodoform, found miliary tubercle present on microscopic examination; but there is no information as to the presence of bacilli. Poten then records a case of peritoneal tuberculosis in a woman where bacilli were found. Frau K., twenty-nine years of age, had three children, the last a year and a half before. During the suckling of her youngest child had swollen limbs, which continued after weaning. Afterward swelling of the abdomen began, and also some prolapsus uteri. Weakness and wasting were also present.

On examination the abdomen was found markedly swollen, especially at and below the umbilicus. The abdominal walls were somewhat stretched, soft, and could be indented. Fluctuation was distinct, but there was no special hardness. On percussion the note was markedly tympanitic below the liver, dull between the symphysis and a point a hand's breadth above the umbilicus, as well as in the flanks and on change of position.

The anterior vaginal wall was slightly prolapsed, the uterus retroposed, movable, and with no evident tumor attachment. Fluctuation in Douglas's pouch doubtful per rectum. Diagnosis was thus difficult.

On abdominal section clear yellow fluid issued in a stream from the incision. The peritoneum and intestines were then seen to be covered with small nodules of a grayish-red color; uterus and ovaries unaltered in size, but also covered with nodules. All the fluid was removed, a piece of the peritoneum resected for microscopic examination, and the incision closed.

The patient recovered perfectly so far as the operation was concerned, and was, a year after the operation, in good health, with no tubercular affection apparent.

The piece of peritoneum removed was 2–3 mm. thick, and dense in consistence. On section it was grayish-red in color, with yellow specks. The free surface showed little prominences about the size of a millet-seed, and without ulceration; the sheen of the peritoneum was lost. In section perpendicular to the surface, one could see a cellular granulation tissue, which seemed toward the surface more like connective tissue. Tubercles, single and in groups, were present, and most abundant in the deeper layers of the thickened peritoneum; they form the miliary prominences at the surface already alluded to. They show the most varied forms, from simple granulation knots to developed wandering tubercle cells, with central caseation. Abundant fat cells lie near the tubercles and in the loose subserous tissue.

The demonstration of the bacilli was attended with difficulty. In many of the sections no bacilli could be found, but ultimately they were found, though sparingly, in some of the wandering cells. They were usually single, but in one cell two were noted.

ON PERIUTERINE HÆMATOCELE.

GUSSEROW points out (*Arch. für Gynäk.*, Bd. 29, Heft 3) that of late years our knowledge in regard to hæmatocele has been increased by Kuhn, who showed that we could have extraperitoneal hæmatocele apart from the puerperium; by Gallam, who as early as 1855 pointed out that the greater number of hæmatoceles were due to burst tubal pregnancies; and finally, in regard to treatment, by the clinical work of Zweifel, Martin, and others.

Gusserow then takes up the consideration of eight cases of retrouterine hæmatocele on which he operated.

Case I. Frau E., thirty-six years of age, first menstruated when sixteen. The period was regular, and lasted two days; her last period was on September 11, 1885. She has had five children, the last in 1876. After an abortion in 1878 she had pelvic inflammation, which kept her in bed for six weeks. On March 1, 1885, bleeding came on, which lasted till November 7. Great abdominal pains came on then, especially at the right side, but diminished after a practitioner removed some membranous shreds. The pains, however, continued. On the 19th she had severe attacks when the bowels or bladder acted, and therefore sought admission to hospital on the 29th.

On abdominal palpation, the abdomen was soft and painful in both iliac regions. Through the abdominal wall one could feel a tumor on the right lower regions, with an upper convex border reaching as high up on the right as the anterior superior spine and navel. It did not reach as high in the middle line. The posterior fornix was bulged with an elastic tumor and the cervix pushed forward to the symphysis. The tumor could be felt on both sides of the uterus.

Diagnosis. Retrouterine hæmatocele. The pains increased, but there was no fever; the abdomen became tympanitic, and there was great difficulty in evacuating the bowels and bladder; while the tumor did not increase for three weeks, neither did it diminish. The posterior fornix was therefore incised, the patient being chloroformed, and a large quantity of black, broken-down blood, as well as fresh and old clots, washed out with salicylic acid. A drainage tube was then inserted, and the vagina packed with iodoform gauze. The patient improved decidedly after this, and the tumor diminished to the size of a child's head.

On December 26 the catheter for washing out passed toward the right into a compartment of the tumor, and evacuated 400 to 500 c. cm. of a dirty fluid, which clotted in part on exposure, contained much albumen, and red and white blood-corpuscles. The patient continued well till January 11, when the swelling again filled, and severe pains came on; menstruation was not present. Pulse 100°, temperature 38.2° C. By injection a considerable amount of fluid was evacuated on the 15th, but the patient's condition did not improve on the 28th. Abdominal section was performed, and the cyst-like walls of the sac stitched to the abdominal walls. A drainage tube could then be passed, and all secretion drained through the vagina. The patient improved until July 3, when she had all the symptoms and signs of perforative peritonitis, viz., distention, sickness, almost imperceptible pulse, etc. All this passed off under the free use of stimulants. Patient was practically well on March 4.

Case II. Frau D., thirty-seven years of age. Had nine children; an abortion in 1882, followed by pelvic inflammation. On December 18, 1885, had severe pain in abdomen, with uterine hemorrhage; on January 6 a tumor was felt through the left lateral fornix and in Douglas's pouch. Its upper boundary was above the pubis, and the uterus was to the front, though still retroflexed. Temperature normal.

The tumor was incised per vaginam, and the finger passed into the loose œdematous connective tissue. A considerable amount of dark blood was thus evacuated, and old blood clots removed with a blunt curette. No evidence of extrauterine pregnancy could be found. The edges of the sac were sutured to the vaginal incision, and the cavity packed with loose iodoform gauze. The gauze was removed in a few hours, and a drainage tube passed. Recovery good. Douglas's pouch free, uterus retroflexed and fixed somewhat to the right side. The other five cases are much like the preceding in their history, physical signs, and treatment. All the eight recovered.

The critical remarks given on these cases are as follows: Gusserow believes his cases to have been hæmatomata—*i. e.*, extraperitoneal effusions of blood. Case II. he believes to have been hæmatoma of the left broad ligament. In regard to the diagnosis of the hæmatoma of the broad ligament, he asserts that the important points are that the upper half cylindrical boundary can be felt while handling any tumor case—he felt it in Douglas's pouch. The lateral position of the tumor, and its mobility at first, are also valuable in pointing to this diagnosis. The remaining finger can be passed behind and in front of the swelling, but notes its lateral continuity with the uterus and pelvic wall.

In four of his cases Gusserow suspected extrauterine pregnancy as the cause of the effusion, but found no evidence of this in the blood evacuated. He points out that there need be no fear of septic infection by this operative interference and that by it pains, etc., are immediately removed and the patient cured in a period varying from twelve days to three weeks. The details are as follows: Case 1, cured in three weeks; Case 2, in three weeks; Case 3, in twelve days; Case 4, in eighteen days, etc.

The following was the method of opening the blood effusion. The vagina was first douched with corrosive sublimate solution 1:2000, and then the lowest point of the tumor punctured with a lancet-shaped knife, the incision being enlarged as required. The clots were then washed out with salicylic acid solutions and the walls of the cyst, when distinguishable, stitched to the vaginal mucous membrane. A thick drainage tube was inserted and the vagina tamponed with iodoform gauze.

Gusserow considers this method superior to treatment by laparotomy. He recommends operative treatment only in cases where absorption of the blood is delayed or where the local manifestations are severe.. The majority of cases of periuterine hematocele are cured with rest in bed.

On Cancer of the Uterus.

Williams, in his interesting Harveian lectures (*Lancet*, 1887), defines the term "cancer of the uterus" as meaning a new growth possessing malignant properties—*i. e.*, it possesses the power of invading neighboring tissues and of reproducing itself in the form of secondary growths in other and distant parts. He recognizes three types of malignant disease, viz., sarcoma, adenoma, and carcinoma. Sarcoma is of the connective tissue type. Carcinoma and adenoma are of the epithelial type. This classification is not perfect, of course, as we may have what looks like a mixed form, and sarcoma may assume an alveolar form like adenoma.

The uterus is considered as divided into three parts, viz., the vaginal portion, the cervix, and the body. The portio lies projecting into the vagina; the cervix is bounded below by this and above by a plane passing through the portion where the characteristic cervical structure ends and the tubular glands of the uterus begin. This, of course, gives also the lower boundary of the body. Dr. Williams condemns rightly the use of the terms scirrhus, encephaloid, medullary, and epithelioma.

Cancer of the portia vaginalis is defined as beginning in the stratified epithelium on the vaginal surface or in the transitional epithelium at the os externum. He thus excludes sarcomata and glandular cancer. Eight cases are described in their clinical features and the microscopic examination of the parts removed given. The disease was found to begin at one or several points, not to spread into the cervical canal but to creep toward the vaginal wall, thus advancing superficially in seven of the cases. Seven of the cases were married, but they had less than the average number of children. The earliest symptom was hemorrhage.

Before taking up cervical cancer, the nature of the so-called erosion is considered. A true erosion is defined as being a surface with a structure like that of the mucous membrane of the cervical canal lying in the position usually occupied by squamous epithelium. It differs from cancer in that its epithelium is in single layer, and from adenoma in the glands being comparatively superficial. He believes such erosions to be produced by the glandular epithelium proliferating and then destroying and replacing the squamous epithelium beneath which they lie. The stroma around the glands is also active, being infiltrated with nuclei and small cells. The view advanced differs from that of Ruge and Veit, who hold that the glands in an erosion arise from a change in the deeper layer of the stratified epithelium.

Cancer of the cervix begins in the glands, which increase in number and grow where usually they do not exist. Their epithelial lining proliferates, becomes multiple-layered, and may fill the gland lumen. It may exist in a polypoid, papillary, or nodular form; the two latter forms passing into the substance of the cervix and connective tissue around it—the very worst direction possible from an operative point of view. They avoid encroachment on the uterine body and vaginal walls.

Cancer of the body of the uterus is either adenoma or true cancer, both growing from the gland epithelium. It spreads into the muscular coat and may open into the intestine, or cause inflammatory adhesions. The glands affected are those of the broad ligament or of the connective tissue anterior to the spinal column. In all the cases the disease begins after the menopause, the ages averaging from fifty-three to sixty-three.

Dr. Williams discusses finally the question of radical treatment, and advocates supravaginal amputation for cervical cancer as against total extirpation. For cancer of the body, of course, total extirpation is the only remedy.

The Etiology, Pathology, and Classification of Salpingitis.

The question of the pathology of salpingitis has been a matter of controversy between Tait, of Birmingham, and Sänger, of Leipzig. We have no intention of judging between the two combatants, but merely summarize the excellent *résumé* of the classification and pathology of salpingitis given by Sänger in a letter addressed to the President of the Chicago Gynecological Society (*Amer. Journ. of Obstetrics*, March, 1887).

Sänger bases his pathology on the germ theory and the anatomical relations of the sexual organs. The genital tract from hymen to frimbriated end of Fallopian tube is exposed to access by organisms which may pass from the external medium to the tubes either along the mucous membrane or through the lymphatics; mischief may also pass from the peritoneal cavity into the tubes.

Various microörganisms have been found in the genital tract, but those considered the cause of disease (pathogenous microörganisms) are not many. Sänger classifies the forms of salpingitis into three groups, as follows:

Group I. *Forms of salpingitis produced by known specific microbes.*

1. Salpingitis gonorrhœica, produced by the gonococcus of Neisser.
2. Salpingitis tuberculosa, produced by the bacillus tuberculosis of Koch.
3. Salpingitis actinomycotica, produced by the actinomyces bovis of Ballinger.

Group II. *Forms of salpingitis due to specific microbes identical with those producing traumatic infection.*

1. Salpingitis septica.

Group III. *Forms of salpingitis produced by specific but as yet unknown microbes.*

1. Salpingitis syphilitica.

Group I. Gonorrhœal salpingitis is admitted by all as a form, the only point denied by some being whether the gonococcus of Neisser is the cause of it. All admit that gonorrhœa spreads to the tubes and sets up this form. Sänger shows that the tube becomes distended with pus, chiefly at the abdominal end, while the uterine end becomes thickened; the peritoneum becomes infected by the pus escaping through the ostium abdominale. Gonorrhœa produces only surface suppuration, and any abscesses in the psoas ligament or ovaries are usually septic.

It must not be forgotten that while Neisser's gonococci are found abundantly in the gonorrhœal pus from the cervix, their demonstration in the tubes is difficult, and in some cases of undoubted gonorrhœal salpingitis they have not been found.

Salpingitis tuberculosa is known chiefly through Hegar's work (Amer. Journ. Med. Sci. for April, 1887, p. 586), and is a distinct affection from the caseating pus of a pyosalpinx. This latter should be termed "coagulation necrosis."

Salpingitis actinomycotica is undoubtedly one of the greatest rarities in gynecology, but has been described by Zemann in his paper "Ueber die Aktinomycose des Bauchfells und der Baucheingeweide beim Menschen." In this case the tubes were dilated and purulent, with clumps of actinomyces present in the lumen of the tube and granulations in the walls. The fungus had passed from the intestines or vagina. [Descriptions of this fungus will be found in Klein's *Microörganisms* and Woodhead's *Pathology.*]

In the forms of salpingitis known as septica and syphilitica the evidence of their being due to a pathogenic microörganism is not yet complete. It must be remembered that the pathogenous microörganism of syphilis has not yet been discovered, and much has yet to be done in regard to those and septic conditions.

The Pathology of Chronic Inflammatory Disease of the Uterine Appendages as Illustrated by the Preparations of Sixty-three Cases removed during the Year 1886.

Mr. Lawson Tait gives, in the *Brit. Med. Journ.* of April 16, 1887, his views of the pathology of chronic inflammatory disease of the uterine appendages, as illustrated in a series of 63 cases operated on by him during 1886.

Mr. Tait recognizes five classes of cases as follows: First, catarrhal; secondly, those produced by the exanthemata at the time of puberty; thirdly, gonorrhœal cases; fourthly, those occurring from inflammatory mischief in the post-puerperal state; and lastly, cases where the uterus is infantile, and the appendages disorganized by inflammatory action.

The following are the statistics of the 63 cases: There was only one death. The gonorrhœal and post-puerperal cases preponderate, inasmuch as 53 of the women were married, and in 3 of the unmarried the cause was undoubtedly gonorrhœa. One case of double pyosalpinx followed the prolonged use of intrauterine pessaries intended to remedy an anteflexion.

In every case there was no possibility of the woman becoming pregnant, as in the majority the trumpet of the tube was found glued to the ovary; in others the fimbriæ were coalesced, the ovary remaining free.

In one-third of the cases the exanthemata, usually scarlet fever, had caused the inflammatory condition. The condition of the tubes varied. In the early stages they were intensely congested and friable; in the later cases the appendages were cirrhotic, and few Graafian follicles were present in the ovaries. The nature of the fluid contents varied, but was either cheesy or serous. He did not believe this had much bearing in determining the patient's sufferings; this was due to the adhesions.

MEDICAL JURISPRUDENCE AND TOXICOLOGY.

UNDER THE CHARGE OF

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Statistics of Crime in Europe.

According to the journal *L'Italie* (*Annal. d'hygiène publique*, sr. 3, t. xvii. p. 57), the number of individuals, per 100,000 inhabitants, convicted of homicide is in Italy, 8.12; Spain, 7.83; Hungary, 6.09; Austria, 2.24; Belgium, 1.78; France, 1.56; Germany, 1.11; Great Britain, 0.60. In respect of assaults, with injury to the person, Austria takes the first place with 248 per 100,000 inhabitants; Belgium, 177; Italy, 162; Germany, 129; France, 65; Hungary, 46; and Great Britain only 7. For criminal (immoral) assaults, the numbers are; Belgium, 15; Germany, 14; France, 10; Austria, 9; Hungary, 6.5; Italy, 4; Great Britain, 1.7; Spain, 1. In number of convicted thieves of all kinds, Germany takes the highest place with 222 per 100,000 inhabitants; Italy, 154; Great Britain, 147 (Scotland, 222); Belgium, 128; France, 112; Hungary, 77; Austria, 60; Spain, 56.

If the figures for the various crimes are added together for each country, it appears that Germany has the greatest amount of criminals, and Great Britain the least, among European nations.

CONTRIBUTION TO THE MEDICO-LEGAL STUDY OF FOOTPRINTS.

MASSON (*Annal. d'hygiène publique,* ser. 3, tome xvi. pp. 336–345, 1886) gives the results of an investigation of a case of murder in which the footprints of the assassin were of importance. A woman was found murdered in an isolated house in the neighborhood of Constantine. On the floor of her chamber were observed seven blood-stained imprints of a naked foot, and that the right foot. Seven persons were suspected of the murder, and the footprints had therefore to be compared with the right feet of all of them. The presumption was that all the footprints were those of the foot of one individual.

The author regrets the meagre instruction on footprints in medico-legal text-books. Causse's well-known method of measuring footprints he did not find to be of much service in this case. The author divides the investigation of a footprint into three distinct operations: (1) the taking of the footprint; (2) its measurement; (3) the attentive study of its particular qualities or peculiarities, which give to each footprint a special physiognomy. In order to take the footprint of a suspected person, he is asked to step on some defibrinated blood, or a gummy solution of fuchsine, and afterward to stand or walk on a piece of stout paper, in order to obtain a print under both conditions. The prints are then measured by drawing a straight line along the inner edge of the print, touching the heel and ball of the great toe. Then another line, parallel to this, is drawn along the outer side of the print, and touching it. These lines are joined by three lines parallel to one another, but at right angles to the first lines. One of these lines touches the point of the great toe; another touches the hinder part of the heel; and a third passes across the foot immediately behind the ball of the great toe. The foot is thus enclosed in a rectangle, representing the greatest length and breadth of the footprint. It is important to note the distance between the back of the heel and the front of the print of the ball of the great toe. This measurement is less variable than the total length of the footprint. The maximal distance of the inner edge of the footprint from the inner tangential line is also to be measured, as an index of the height of the plantar arch. A line is to be drawn touching the points of the impressions of the second and fourth toes, and the height of the angle which this line, when extended, forms with the inner tangential line is to be noted. It varies much in different individuals.

Masson carefully studied the variations in the above measurements, as seen in different prints of the same foot. He found in twelve subjects that the chief variations were as follows: 9 to 23 millimetres ($\frac{3}{10}$ to $\frac{9}{10}$ inch) in the length of the footprint; 0 to 8 millimetres ($\frac{3}{10}$ inch) in its maximal breadth; 0 to 5 millimetres ($\frac{2}{10}$ inch) in the measurement corresponding to the plantar arch; and 0 to 21 millimetres ($\frac{8}{10}$ inch) in the height of the angle of the toes. The extremes of the variations are met with in the prints from the foot standing, and those from the foot walking or running. He found that an added weight of forty pounds does not sensibly alter the footprint. In studying the physiognomy of the footprint, attention is to be paid to the marks of the toes, and especially to that of the great toe. In the latter, it is very important to distinguish the two parts of it; the anterior and larger corresponding to the mass of the toe, and the posterior and smaller (sometimes wanting) due to the flexor tendon. This smaller part varies much in different individuals. It is rarely absent from the print of the foot when walking, but may be so if standing. Applying these rules and considerations to the particular case in hand, Masson found a similarity between the footprints of blood on the floor of the chamber, and those of one of the suspected persons. Other circumstances afterward occurred to prove that this was the murderer.

Diagnosis of Death by Hanging.

Coutagne (*Arch. de l'anthropologie crim. et des Sciences pênales,* 15 Mai, 1886) believes, contrary to the view expressed by Jardieu, that the diagnosis of death does not depend essentially on the examination of the exterior of the body. The author especially insists on attention being paid to the internal lesions of the neck, which are generally more associated with judicial hanging than with suicidal hanging. Out of 24 autopsies of suicidal cases which he made, only 5 gave negative or doubtful results as regards the internal appearance of the neck. In 17 cases there was hemorrhage into the cellular tissue or into the muscles; in 10 cases there was rupture of the muscles; in 8 cases fracture of the hyoid bone; and in 8 cases fracture of the hyoid cartilage. He insists on the importance of examining the soft parts at the back of the neck. The lungs of hanged persons present some special characters, which Coutagne describes under the name of *carmine œdema,* and believes them to be dependent on an affection of the pneumogastric nerves.

The Medico-legal Significance of the Biperforate Hymen.

Prof. Demange, of Nancy, reports two cases of biperforate hymen, and both in married women; the one a young widow after six years of married life without children, the other a wife advanced in pregnancy. In the former case a fibrous band passed anterio-posteriorly dividing the vagina into lateral halves; in the latter the band passed transversely dividing the vagina into an anterior and into a posterior part. Demange felt satisfied that at least in the former of the cases the biperforate hymen was not the result of imperfect rupture during attempted coitus. He therefore agrees with Delens and Cornil, and differs from Tardieu, in believing that a biperforate hymen is generally a natural condition, and is not always, if even frequently, the result of attempted coitus.

SPONTANEOUS CLOSURE OF THE EYELIDS AFTER DEATH.

Incited to the investigation by the paper of Galezowski on "The State of the Eyelids after Death," read before the Medico-Legal Congress in 1878, DR. VALUDE has made a large number of observations on this subject (*Annal. d'hygiène publ.* ser. 3, t. xvii. pp. 168–172). The main question which he endeavored to answer was, At what time after death do the eyelids close spontaneously? His observations extended over one hundred bodies. He found that during the first twenty-four hours after death the eyes were completely closed in 7 of the cadavers. In 12 of these one eye was closed and the other was open. In 15 both eyes were widely open. In 66 the eyes were moderately open, or half closed. He never observed the eyes open spontaneously after they were closed, even though he observed the body for two or three days. In 50 cases, where the eyes were observed to be fully open or half open immediately after death, at a second inspection, some hours later, the eyes were found to have remained in the same condition in 21 of these, while in 23 the eyes had slightly closed. Only in one case was a half-open eye found next day to be widely open. This he considers quite exceptional, and attributes it to the probable interference of the physician who made the autopsy. He further states that if the eyelids had not begun to close before the expiration of forty-eight hours from death, they seldom closed during the two following days.

The author concludes (1) that in 10 per cent. of subjects the eyelids are closed at death; (2) that in 90 per cent. the eyelids are open or half open; (3) that in about 42 per cent. of the latter the eyelids do not change, while in 46 per cent. more or less complete closure gradually occurs. He believes it to be possible, from inspection of the eyelids, to say whether they had closed spontaneously or whether they have been closed by the hand of an assistant. A whitish mark of the finger is, in the latter case, left on the upper eyelid, which is difficult to describe but fairly easy to recognize.

CICATRICES OF LEECH BITES.

DR. CASTRO, of Italy, states (*Annal. d'hygiène publ.*, ser. 3, t. xvii. pp. 48–50) that he recently had occasion to inquire into the presence of scars as the result of leech bites. He made thirty-seven experiments on different individuals, with the result that in several cases it was impossible to discover a scar by the naked eye. But in such cases the scar became evident after rubbing the skin with tincture of mustard, which reddens the skin surrounding the scar, leaving the scar white.

COCAINOMANIA.

ERLENMEYER (*Deutsche Mediz. Zeitung*, 1886) presents us with a study of this new disease, analogous to morphiomania, and reports a large number of cases in which patients have had recourse to large doses of cocaine with the object of avoiding the morphine habit. The results of immoderate use of cocaine consist in symptoms of vascular paralysis, quick pulse, profuse sweatings, disturbed respiration, and syncope. Erlenmeyer points out the dangers to which such persons are subject if required to be anæsthetized by chloroform.

There is progressive emaciation, as in the case of morphiomania, the weight being lost to the extent of twenty or thirty per cent. The complexion becomes cadaveric, the eyes hollow, and the muscles flabby. Sleeplessness is a marked symptom. At an advanced stage psychical derangements manifest themselves, more especially of the nature of delusions as to persecution. Short of this there may be hallucinations of sight, with great intellectual depression, and with loss of memory. In some there is great prolixity in speech and in writing. Some of Erlenmeyer's patients had to be confined in a lunatic asylum. Erlenmeyer considers the prognosis of morphiomania to be very grave if it is associated with cocainomania.

ANALOGY BETWEEN DUAL INSANITY AND DUAL SUICIDE.

CHPOLIANSKI (*Thèse de Paris*, 1885) points out the following analysis between dual suicide and dual insanity:

Dual Insanity.	*Dual Suicide.*
1. One subject is insane; he imposes his insanity on the other—*imposed insanity.*	1. One subject has the intention of suicide; he imposes it on the other—*imposed suicide.*
2. Two subjects become insane simultaneously under the influence of the same cause—*simultaneous insanity.*	2. Two subjects intend suicide at the same time under the influence of the same cause—*simultaneous suicide.*
3. Two subjects, equally predisposed, fall into the same fit of madness, but the one does so first, the other follows, compelled by the example of the first, and by predisposition—*communicated insanity.*	3. Two subjects have the idea of suicide, but the one commits suicide first; the other, fascinated by the idea or the act of the first, commits suicide at the same time, or soon afterward—*communicated suicide.*
4. An insane subject changes his ideas for those of a more intelligent madman—*transformed madness.*	4. An eccentric subject has his ideas directed to suicide under the influence of a notorious suicide, or in troublous times—*transformed suicide, or epidemic suicide.*

THE PRESENCE OF FREE PHOSPHORIC ACID AS A PROOF OF POISONING BY SULPHURIC ACID.

PROFESSOR GARNIER, of Nancy, investigated a case of poisoning by sulphuric acid, in which, though indubitable signs of the mode of death existed in marks on the clothing, and in the black carbonized condition of the alimentary canal, as also in the presence of a trace of arsenic—a common impurity of sulphuric acid—in the canal, and although the carbonized organs had a strong acid reaction, yet on extraction with alcohol and ether no reaction of sulphuric acid was obtainable from the extract. From a further investigation of the subject, Prof. Garnier believes that in such a case the sulphuric acid has acted on the phosphates normally present in the tissues, and displaced the phosphoric acid, the latter acid then becoming the free acid found in the alimentary canal. He gives several experiments in support of this view.

ARSENIC IN SOIL.

PROFESSORS GARNIER and SCHLAGDENHAUFFEN, of Nancy, recognizing the difficulty thrown in the way of the investigation of cases of arsenical poisoning by the ever-recurring suggestion that the arsenic found in the dead body has entered the body otherwise than in the form of poison, have made an experimental inquiry (*Annales d'hygiène publique*, ser. 3, t. xvii. pp. 28–37, 1887) into the subject. They divide the methods by which arsenic may enter the body in other form than poison into four groups: (1) the introduction of arsenic into the organism before death in the form of medicine, as Fowler's solution, in ordinary doses, or in the form of drugs containing a trace of arsenic as an impurity, as subnitrate of bismuth, sulphate of potash, etc.; (2) the introduction of arsenic, also before death, in foods and drinks, the organic matters from which these are prepared containing arsenic as an impurity—*e. g.*, sugar, confections, wine and beer; (3) the imbibition of arsenic by the dead body from the arsenical soil of the cemetery in which it is buried; (4) the imbibition of arsenic from the colored clothes in which the corpse may have been buried, or from the paint and metal mountings of the coffin.

The authors in their present investigation have confined themselves to the investigation of the third of these groups, and have made three sets of experiments, with the following results:

I. *Examination of soils naturally arsenical.* Arsenic is found disseminated in various soils in the Vosges in variable but often in considerable quantity, especially in red colored soils. The arsenic is present probably in the form of arseniate of iron. This salt is very slightly soluble in boiling water, but it is completely insoluble in water at the ordinary temperature of the soil. It cannot therefore be dissolved out by the percolating rain.

II. *Absorption of soluble arsenical compounds by non-arsenical soil in presence of water.* The soil chosen for this set of experiments was taken from the cemetery of Préville, Nancy. It was perfectly free from even a trace of arsenic. It is calcareous and of yellowish color, containing a considerable quantity of ferric oxide. A given quantity of the soil was mixed with twice its weight of distilled water, and to this was added a certain quantity of a weak solution of arsenious acid. A portion of the supernatant fluid was from time to time removed and tested for arsenic. It was found that after six or seven months the water contained no arsenic in solution. It had all become deposited in the form of arseniate of iron. Heat facilitated the disappearance of the arsenic.

III. *Diffusion of arsenic into a non-arsenical soil, in contact with soluble and insoluble compounds of arsenic.* Two ordinary graves were dug in the Préville Cemetery, side by side, one of which was afterward filled up and the other kept open. Four months later, cartridges made of white filtering paper, and containing each five grammes of arseniate of iron, arseniate of lime, or arseniate of potassium, were introduced by a boring process from the sides of the open grave into the surrounding soil and into the grave which had been filled up. At different periods subsequently the soil surrounding the cartridges were removed and examined for arsenic. No arsenic was at any time discovered except in the case of the soil surrounding the cartridges containing arseniate of lime, where a minute trace of arsenic was recognizable by Marsh's method.

The arseniate of potassium had disappeared, but had evidently been converted into insoluble compounds as soon as it came in contact with the surrounding soil. The authors conclude that the arsenical compounds met with in soil are not likely to diffuse themselves into the body of a buried person.

MODE OF ACTION OF SULPHURETTED HYDROGEN AND ALKALINE SULPHIDES.

JULIUS POHL, in the *Archiv f. Experimentelle Pathologie u. Pharmakologie* (Bd. xxii. p. 1–25), gives the results of an investigation of the above subject, which he conducted in the pharmacological laboratory at Prague. His experiments were made on frogs and rabbits, and in two instances on dogs. Assuming that sulphuretted hydrogen, when it mixes with the blood, becomes converted into an alkaline sulphide, he employed a neutral solution of sulphide of sodium in nearly all his experiments, injecting it into the lymph-sac of the frog and the jugular vein of the rabbit and dog. The symptoms in the case of frogs, when a dose of 0.01 gramme (0.15 grain) was employed, were remarkably constant, and consisted of narcosis, central motor paralysis, slowing of the heart, with general enfeeblement of the cardiac muscle, ending with stopping of the heart in diastole. Fibrillar twitchings of the muscles were also observed. Death occurred in one and a half to two and a half hours, when a large dose was injected; in six or more hours when a smaller dose was given. In some cases rigidity of the muscles was observed. The poisonous symptoms in rabbits were not so constant as in frogs. In almost every case violent convulsions were present, with deep, labored breathing, plaintive cries, and slight tremors of the muscles. The convulsions were proved to be of cerebral origin. In the few cases in which convulsions were absent, a general and gradually increasing paralysis of the muscles was observed, with increased frequency of the respirations, and general exhaustion, ending in death. The lethal dose of the sulphide injected into the vein was about one and a half to two grains for an adult rabbit (about one-twentieth of a grain for each pound). Such a dose proves fatal in about an hour. The blood, though dark in color, contained oxy-hæmoglobin, and no sulph-hæmoglobin. In a few cases the hæmoglobin was reduced. The blood pressure rapidly sank, even after very small injections. This was probably due to the action of the sulphide on the vasomotor centres.

In order to ascertain whether the toxic action of the sulphide was due to its oxidized products, experiments were made with sulphite and hyposulphite of sodium, but although much larger doses than those of the sulphide were injected, no effect was observed on the blood pressure or otherwise. The toxic action, was, therefore, not due to oxidized products, nor was it caused by the sulphide abstracting oxygen from the blood; for the symptoms were not those of asphyxia, nor were similar symptoms observed when strong reducing substances were injected into the blood, such as hyposulphite of sodium, hypophosphite of sodium, phosphite of sodium, aldehyde, acetone, pyrogallol, etc. Some experiments were made by digesting the sulphide with defibrinated blood, and then injecting it into the jugular vein. A lethal result was still obtained, but the symptoms were somewhat different from those of the pure sulphide. The well-marked action on the blood pressure was wanting. The author is, therefore, of opinion that the toxicity of the sulphide is due to its own action on the tissues, and not to the action of oxidized products or other transformations of it.

PUBLIC HEALTH.

UNDER THE CHARGE OF

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Vaccination in Russia.

Dr. Ucke gives an interesting account of the present condition of vaccination in Russia. The benefits of vaccination, he says, are only now beginning to be realized by the peasants in Russia. As early as 1811 the Emperor ordered that all medical men should vaccinate; and that peasants, chosen from certain districts, should be educated in this particular at the cost of the community, and sent into the provinces to vaccinate. Annual reports were sent to the authorities, but it was soon shown that vaccination was not producing any effect on the smallpox epidemics which decimated the country. At first it was believed to be the lymph; but even though animal lymph was employed, the result was the same. It was then thought necessary that some control should be exercised over the vaccinators, and accordingly this work was added to that already occupying the medical inspector of each province. This again failed, and it was easily explained. In 63 provinces, each having an area of 1500 square miles, 5000 villages, and about 80,000 children, there was but one inspector, and he could only vaccinate at such times as the peasants were not occupied in cultivating their land—*i. e.*, in the winter time, an impossibility with such a climate as that possessed by Russia. Thus vaccination ceased to be enforced almost until 1881, when local self-government having been given to thirty-four provinces, it was determined to appoint a commission to consider the question of vaccination. The territory which it was thus proposed to deal with consisted of the whole of the central provinces of European Russia, with the exception of Poland, the Baltic Provinces, the country of the Cossacks, and the provinces of Archangel, Astrachan, and Orenburg, and it has an area of 51,444 square miles, about 53,000,000 of population, and probably 2,710,000 children amongst them. These 34 provinces are divided into 360 districts; each of these manages its affairs for itself, and up to 1864 there was only one hospital of twenty beds in each district, and a peasant vaccinator in each village. These hospitals were somewhat improved after this date, and the vaccination was left to dressers, instead of to the peasants; but there was no control over the medical inspectors, who, in some places, left everything to the dressers, in others allowed people to come to them, and in others sought them out in their own homes. The vaccination report for 1882 stated that at least one-third of the children were unvaccinated, and probably that was not stating the whole truth.

The Commission was occupied first with the question of the production of lymph, then with vaccinators, and thirdly with arranging the plan by which vaccinations were to take place regularly, and how systematic control could be exercised over all vaccinations.

After but a short discussion, it was decided to use animal lymph on account of the prevalence of syphilis in Russian villages, and the fear that arm-to-arm vaccination would aid in spreading the disease. As but few doctors and dressers could maintain a supply of animal lymph, it was determined to keep up a central station, where vaccination could be efficiently taught and lymph obtained for distribution.

Hitherto, also in Russia, owing to the distances to be traversed, and the scarcity of medical men, vaccination was left to "dressers," and this the Commission considered must be continued, only that a medical man should control each of these people, and ascertain that his work was properly performed, and measures should also be taken to have them better instructed.

The system thus designed is for the priests in every district to send at a fixed period a list of all the children born during the past year. A list of the number of villages is sent to a dresser, with the dates when he is expected to visit. Upon his arrival at the first village he vaccinates a calf, and then goes to the next village, leaving directions for the management of the first calf, there he does the same, and also on the third day. The fourth day he returns to the first village, takes lymph, vaccinates the children, and continues his journey, so that in six days he has vaccinated in three villages, and has also obtained lymph sufficient for the next villages. In every village he leaves a report of whom he has vaccinated. As soon after as the pustules might be considered to be developed, the doctor arrives with two dressers; he is provided with lymph, in case of failure of those previously operated upon, and thus he examines and journeys through all the villages previously vaccinated by the dresser. The work is so arranged that only twenty-four days in the month are counted upon, because of possible hindrances, and only during nine months of the year, because of the work in the fields during the other three months. The number of medical men and dressers varies according to the size of the district and number of inhabitants to each mile. When the expedition is over, the lists of those vaccinated are written up and sent in to the authorities.

Thus it will be seen that the ambulatory system of medical attendance will be the most useful for a country like Russia, the only danger to be guarded against is the scarcity of medical men, not less than one for every hundred villages being necessary.

Besides, in journeying every year through the districts, the doctors will learn the habits, customs, and diseases of the inhabitants, they will have leisure to prescribe for and visit their patients, and the dressers will be useful in visiting patients and preparing medicines. Every medical man is to be provided with a medico-topographical list of questions, in order that he may obtain information from all the villages, and that which he fails to obtain one year may be asked for the following, until a perfect history of all districts can be collected.

What results this new vaccination legislation will produce can only be seen after many years of work.—*Deutsche Vierteljahrsschrift für öffentliche Gesundheitspflege,* Bd. xviii. Heft 3, 1886.

INFLUENCE OF SMALLPOX HOSPITALS.

The Local Government Board of England have recently issued the report of their medical officer, DR. GEORGE BUCHANAN, F.R.S., which contains a *résumé* of the evidence which has been adduced as to the influence of smallpox hospitals situated in London. Everyone of the five hospitals under the control of the Metropolitan Asylums Board, and also two others under different management, have given rise to smallpox in their neighborhood. The influence of the hospital at Fulham had been especially investigated by the Board's medical inspector, Mr. W. H. Power, and Dr. Buchanan now states that the whole of the experiences on record concerning the districts of London which are in special relations with smallpox hospitals, combine to form a very strong corroboration of the view of the Commission of 1881, that in the metropolis all smallpox hospitals share the disastrous ability of the Fulham hospital to spread smallpox by some means or other over the neighborhoods around them. This ability is now proved to extend to the distance of at least a mile, and to be independent of lines of human communication. It has now been shown to be exerted when the number of acute cases in a hospital has been restricted to twenty or thirty, and it was on one occasion exerted when only five acute cases were in the hospital together. It has not been extinguished, as Mr. Power's recent researches and the reports of health officers show, by the regulation of methods of transit, or by the removal of opportunities for personal communication with patients in the hospital.

It is to this influence of hospitals in maintaining smallpox over large areas of the metropolis, that must needs be ascribed a measure of that excess which has recently become conspicuous in the smallpox death-rate of London as compared with that of the provinces. This changed attitude of London toward the provinces, dating from the time when the former, and not the latter, became plentifully supplied with hospitals for smallpox, deserves especial consideration by any whose first thought is for the aggregate metropolis. For those whose concern is with the particular sections of London the facts will suffice that the five intra-urban smallpox hospitals in London have excess of smallpox around them, and that in the case of the hospital which has been especially studied (Fulham), this excess has amounted (during such portions of ten years as have seen the hospital at work, but not during other portions of the ten years when it was shut) to a threefold incidence of smallpox upon the three nearest square miles as compared with the incidence on the remainders of circumjacent districts. Dr. Buchanan therefore submits that the time has now come when the other means recommended by the Commission for "reducing the chance of spreading infection" ought to be tried.

The volume also contains, in appendix, a detailed memorandum on "Further Observation (1884–85) of the Influence of Fulham Smallpox Hospital on the Neighborhood Surrounding It," by MR. W. H. POWERS. The memorandum shows that when circles are drawn round the hospital having respectively a quarter mile, half mile, three-quarter mile, and one mile radius, there has been the greatest incidence of smallpox upon that nearest to the hospital, and a less incidence on every successive ring in proportion as it is distant from the hospital; that this is equally true for each of the segments produced by dividing the area round the hospital by lines running from north to south and from east to west, and is further true when these lines are drawn from northwest to southeast, and from northeast to southwest. It should be noted that during the period when the hospital had this influence, every practical means had been taken for limiting the number of communications between the hospital and the outside world, and for rendering any danger to outsiders from such communications infinitesimal; an excellent ambulance service has been provided; and the number of sick in the hospital at any one time has been kept down even below the limit which the Hospital Commission regarded as permissible.

ON THE ETIOLOGY OF FOOT AND MOUTH DISEASE.

A valuable paper on this subject is communicated by DR. E. KLEIN, F.R.S., to the same volume. He began his investigation by the examination of the organisms found in the tissue of the vesicle of the foot of the sheep. Two kinds of organisms were found in the diseased tissue: (*a*) bacilli of the size of tubercle bacilli, these stained in fuchsin after Gram's method, resembled the bacilli described by Gottstein and others as occurring normally in sebum in between the epithelial cells of sebaceous glands; (*b*) small micrococci occurring singly as dumb-bells, and particularly as longer or shorter chains or streptococcus; their number was not, on the whole, very large, but they were present in all the sections; they occur in the cavities of the vesicles and amongst the superficial parts as well as amongst the cell infiltrations of the deeper parts of the corium. They are found less abundant in the vesicle stage, more abundant in the formed ulcers, most abundantly in the superficial exudation of the ulcer of the mouth.

Inoculation of tubes containing sterile nutritive gelatine, or sterile agar-agar meat extract peptone, with lymph taken from a vesicle, led to definite results. In one gelatine and one agar-agar tube the growth on microscopic examination proved a motile bacillus; this, as it increased in number, liquefied the gelatine, and formed a pellicle on the surface. In size and other characters it was comparable to a small species of bacillus subtilis. In another gelatine tube, and in two other agar-agar tubes, the growth had altogether different characters, its progress was extremely slow, and after sixteen days' exposure to 36° C., the growth consisted of small collections of translucent, round, flat droplets or granules placed closely side by side. From one of these agar-agar tubes subcultures were established in a series of tubes containing gelatine, agar-agar, serum, sterile milk, sterile broth, meat extract solution with peptone (1 per cent.), and sterile broth with peptone (1 per cent.).

In the ordinary fluid media there appears as soon as twenty-four hours after incubation at 35° C. a very slight and uniform turbidity, which increases during the next few days; at the end of a week the growth has reached its maximum, but the turbidity is not at any time very great; before this point is reached some growth begins to settle down as a white powdery mass, and after ten or twelve days or so the fluid has become quite clear, the whole having settled down. In sterilized milk it proceeds more slowly. A very remarkable difference exists between cultures in milk and in other fluid media; the growth in milk remains alive even after lapse of several months, in other fluid media, kept for three, four, or more weeks, the growth apparently becomes void of life. Microscopic examinations made of the growth from fluid media show it to consist of dumb-bell micrococci, diplococci, but chiefly of chains, streptococci, composed of 4, 6, 8, 12, 16, or more elements serially arranged.

Sheep, pigs, and guinea-pigs, inoculated with the streptococcus, did not suffer any noticeable illness; injection of a comparatively large quantity of the streptococcus into the cavity of the trachea in the case of two sheep and three calves failed to induce in these animals foot and mouth disease, but feeding four sheep with cultures of streptococcus induced in two of them the typical disease on the feet, a third animal showing lameness without other evidence of having contracted the malady; while the fourth remained well. On the other hand, certain guinea-pigs fed with the same streptococcus did not suffer from foot and mouth disease, but three of them died with disease of the stomach, which seemingly was of like nature in all cases. In two sheep the feeding of the streptococcus had to be repeated three times before one became infected. The symptoms of foot and mouth disease were well marked, and from the vesicle upon the foot of one of the sheep lymph was taken and used for the inoculation of culture tubes, each of which showed after a few days the characteristic growth of the streptococcus. It is noteworthy that five sheep previously inoculated did not suffer from foot and mouth disease when subsequently fed with the streptococcus, their immunity being in all probability due to their having been rendered refractory by the previous subcutaneous inoculation.

Dr. Klein adds, if a previous subcutaneous inoculation with the virus, though it does not effect any conspicuous disturbance of the general health, renders the animals experimented on thenceforward insusceptible to foot and mouth disease, a means would have been found to protect some animals at least against the virulent form of this disorder; but for a completely satisfactory settlement of the question, cattle as well as sheep require to be experimented on, since cattle are the most susceptible of animals as regards foot and mouth disease.

Epidemic of Enteric Fever at Pierrefonds.

Recently, Mons. Brouardel brought before the Académie des Sciences a report on the prevalence of enteric fever at Pierrefonds. He stated that during August and September of last year (1886) 23 persons inhabited three houses adjoining each other, of these, 20 were attacked with fever, and 4 died, 8 were seriously ill, while several hardly suffered at all. The three who were not attacked had only resided in the locality a short time. Previously, in July, one person had been seized with illness after occupying one of the houses, and from 1874 to 1883 this group of houses was five times visited by enteric fever. The street where these houses are situated lies at the foot of a hill, and the drinking water is obtained from a bed of clay covered by a layer of porous sand, about two to three feet deep, and on which are built these houses. In order to procure the water, holes in the form of wells were dug to the depth of 2 to 3 feet. These wells were only distant 9 to 20 feet from leaking cesspools, some of which had not been emptied for 30 years; besides which, the rain-water from the roofs was conducted direct into these cesspools, so that after heavy showers they overflowed, and saturated the surrounding soil with excremental matter. But in order to demonstrate more clearly that the water was responsible for the outbreak of disease, samples were taken from different wells, and examined by MM. Chantemesse and Widal, of the Bacteriological Laboratory in Paris, who reported that they had found bacilli resembling those which Eberth, Gaffky, and others considered to be the enteric fever bacillus, and these were found alive one month after the outbreak. The spleen of one of the patients was punctured, and blood from it also produced colonies of bacilli similar to those in the water. The water from the wells was also chemically analyzed, and that which came from the house where the bacilli were most numerous, contained least evidence of pollution, there being only 8 to 9 milligrammes of organic matter in a litre.

M. Brouardel's conclusions were that the earth does not destroy the germs of enteric fever; that they existed more than a month in the water of one of the wells at Pierrefonds; he states, however, that organic matter may be entirely destroyed if it comes in contact with any alkali.—*Journal de Hygiène*, No. 544, p. 93.

Treatment of Sewage.

Mr. Crump and Mr. Dibdin read papers on the treatment of sewage at a meeting of the Institution of Civil Engineers in London, in which the former pointed out that filter presses afford a ready solution to the question of the disposal of the sloppy mass of putrescent mud daily produced in sewage precipitation works, and that a practically inodorous manure might be obtained, more valuable for crops of hay, potatoes, Swedish turnips, etc., than any farmyard manure. Mr. Dibdin, however, in his paper, though considering that sewage sludge presses are useful in converting the material into a portable form, did not believe that they would ever be really successful except for small quantities; the cost, also, is an almost insuperable obstacle. He believed the furnace, rather than the farm, will be found the most suitable way of disposing of unwholesome matter. In some places, where the quantity is small, it can be mixed with freshly slacked lime, and then run out on to porous beds, where after a few days, it will be found hard enough to cut with a spade and remove; or, as in Southampton, where dry road sweepings are mixed with semi-liquid sludge, and made suitable for the use of the farmer. But with regard to London, the only plan that seemed likely to succeed would be to carry the sludge out to sea, no expense would be incurred in pressing; the sludge need not be visible at all, it could be precipitated in covered tanks, pumped into vessels, and discharged under water, far from land, in the most cleanly and efficient manner. The possible objections to this course were the waste of manure, which, however, is almost proved to be of little value, the nuisance on the coast, which could hardly be created if the system was carried out with care, and the difficulty arising from fogs and bad weather, which could not be considered a real objection. This plan, he acknowledged, though it might be suitable for London, need not be regarded as the only one for other towns, the recent Royal Commission having recommended various methods, such as the application of sludge to the raising of low lands, burning, or digging into the land, the last process being that adopted in Birmingham, where the soil is mostly gravel, and suitable for the purpose. Chemical precipitation is powerless to do more than remove a certain proportion of the oxidizable organic matter in sewage, and Mr. Dibdin pointed out that sulphate of iron used in conjunction with lime, could perform more than twice as much work as alumina and lime; he also stated that the system of filtration as an alternative to precipitation, is a failure, owing to the expense, the choking of the filters, the frequent cleansing, and heavy manual labor required.—*Sanitary Record*, vol. viii. part 94.

There is now in use at Walthamstow, Essex, a well contrived machine, the invention of Mr. Astrop, for extracting water from sludge. The sludge is first received into a large vat, in which are two hollow perforated metal cylinders, covered with fine wire gauze, which is kept clean by the cylinders constantly revolving against brushes; a partial vacuum is created in these cylinders by pumping, and about 60 per cent. of the moisture is extracted, the sludge then passes by a sluice-valve on to an endless web of travelling wire gauze of the width of the machine, and having the same sized mesh as the cylinders. The web is carried on rollers, and passes beneath other rollers, and also over one of Körting's exhausters, by which 10 per cent. of the moisture is removed. It next passes between rollers provided with scrapers, and then falls into a hopper, whence it is conveyed into a disintegrating cage on the lower floor; in this cage it loses more of its fluid by being exposed to a blast of warm air, and thus is converted into a powder, which contains but 5 per cent of its original moisture. In this form it falls through the meshes of the disintegrator on to an Archimedean screw by which it is conveyed to a distance and falls into bags.—*Lancet*, 1887, vol. i. No. 11, page 287.

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All communications intended for insertion in the Original Department of this Journal are only received with the distinct understanding that they are sent for publication to this Journal alone. Gentlemen favoring us with their communications are considered to be bound in honor to a strict observance of this understanding.

Contributors who wish their articles to appear in the next number are requested to forward them before the 10th of April to the Editor,

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Liberal compensation is made for articles used. Extra copies, in pamphlet form with cover, will be furnished to authors in lieu of compensation, *provided the request for them be written on the manuscript.*

The following works have been received for review:

The Science and Art of Obstetrics. By Theophilus Parvin, M.D., LL.D., Professor of Obstetrics and Diseases of Women and Children in Jefferson Medical College, Philadelphia, and one of the Obstetricians to the Philadelphia Hospital. Philadelphia: Lea Brothers & Co., 1886.

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AN EXPERIMENTAL RESEARCH UPON RABIES.

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PASTEUR's work upon and claims in regard to rabies are so well known, more particularly the latter, that any detailed account of them would be superfluous here. Starting with material obtained from a child dead of supposed rabies, in one of the Paris hospitals, he inoculated various animals in different ways—as a result, obtaining a series of symptoms in the inoculated animals of such unvarying character that he classed them under the same head, and considered them to be due to the same cause. Taking the source of his original material into consideration, he felt justified in saying that what symptoms he obtained in his experiments were those of rabies, and that the material with which his inoculations were made contained the specific virus of that disease.

Going on with his work, and extending it in different directions, he announced, first, that by various modifications in treatment to which this "virus" could be subjected its strength could be altered and diminished, and that, by inoculating animals with a virus thus modified an immunity could be established in animals thus treated, against an inoculation with virus of the greatest strength, or against the bite of a rabid animal. Reversing this process, he found that the protective influence was equally established, if the protective inoculations were made *after* the injection of the strong virus, or the bite, had occurred, provided always that the period of incubation of the disease had not passed, and that the symptoms had not made their appearance.

These propositions he proved, or seemed to prove, by a very large number of experiments upon animals, and those most intimate with the results obtained were satisfied that healthy animals—dogs in particular—

could be protected by the measures which he suggested from an attack of rabies after being bitten by a rabid animal.

The next step in this work of Pasteur's, and the one which has attracted so much attention all over the world, was the application to human beings of his methods for the prevention of rabies after a bite by a rabid animal. The preventive inoculations against rabies in human beings began in the summer of 1885, and have been continued ever since, the statistics of results being furnished to the world by means of occasional summaries in the *Comptes Rendus.*

The criticisms to be made against Pasteur in connection with this work are, in the first place, that he fails to give as full details of the individual experiments by which his results have been obtained, as he should have done. By this omission, ground for dissent is given where none might have existed, if scientific men had had the full data before them. In the second place, this omission of detail makes it impossible to know—certainly from any published work of Pasteur's—whether his so-called "virus of rabies," with which his experiments of to-day are conducted, is the continuation of the virus originally obtained from one child, or whether he has taken the opportunity to control the original virus, by obtaining a fresh supply from rabid animals or men coming under observation since the time his investigations first began. In other words, do all of the results which he has obtained depend for their justification upon the reality of a case occurring a number of years ago?

The conditions of the case being as stated, it is hardly to be wondered at that the method of preventive inoculation against rabies has been subjected to severe animadversions, which have at times included its author, and, because the conditions are such as they are, independent observations, and control experiments by, as far as possible, unprejudiced observers are absolutely necessary before the full acceptance of Pasteur's assertions can fairly be demanded of the scientific world at large.

Such independent observations and control experiments may be made to cover a very wide field of investigation, but would include, first of all, the question as to whether others can obtain the same results as does Pasteur—using the same virus, in the same way that he does; secondly, whether this virus which he uses is the true virus of rabies,—a point which will be spoken of more at length further on; and lastly, a more successful attempt than has yet been made to discover the active principle in the material used for inoculation; this active principle seeming, by analogy, to be something with a power of self-reproduction.

So far as concerns the interests of humanity at large, the first is the most important point to be considered, and the endeavor must be made to find out whether—independently of Pasteur's laboratory—there is a virus which, when inoculated in animals, produces the results claimed; whether that virus can be modified in its strength by the treatment he proposes; and lastly, whether, by using this modified virus in a certain way, an attack of rabies can be prevented. As a corollary to these, the question must be answered as far as possible whether any other material treated in the same way will produce the same symptoms when injected into animals.

It is evidence upon these points in particular, which it is desired to present in the following pages.

Upon the 2d of last July (1886), I received from Dr. Hamilton Osgood two rabbits, one of which had been inoculated upon the 19th or 20th of June, in Pasteur's laboratory, and had died on the 28th of June, and been kept upon ice since that time; the second of which was inoculated on the 21st of June in Pasteur's laboratory by Pasteur himself, and in Dr. Osgood's presence, and, alive when received, died on the night of July 4th. From these two rabbits the material for the series of experiments given in this paper was obtained, and the authenticity of the virus, as coming from Pasteur, is unquestionable.

The method of inoculation is well known, but a brief recapitulation will do no harm. The cord of a rabbit or other animal dead of rabies is removed as quickly as possible after death, and with all precautions against contamination. A small portion of this cord, of the medulla, or of the brain, is first beaten up in a little distilled or sterilized water to soften it, and then an emulsion is made of it by beating up this mixture with a small amount of neutral sterilized bouillon. This mixture is allowed to stand, and when the larger portions of the nervous tissue have sunk to the bottom of the vessel, the supernatant cloudy fluid is used as an injecting material. This entire process, against which much criticism has been directed, is merely *a method* by which a convenient form of injecting mass may be obtained. There is nothing in the least mysterious about it—water alone, bouillon alone, or any other equally bland and innocuous fluid may be employed, but in following an experimenter's work his exact methods should be used, and that has been done in this case.

Upon the receipt of the rabbits spoken of, the first question was, do the cords of these animals contain such material that, when inoculated into others, a constant series of symptoms will be produced with such unvarying regularity that the term "specific" can be applied to the cause producing them? With a view to determining this question, inoculations were begun at that time, and have been continued ever since, with the results given below. The inoculations given in this table were all made by trephining the skull, and the injection, immediately under the dura mater—not into the brain substance—of a very small amount of the fluid prepared as described above. At the head of the table stands the abbreviated record of the two rabbits inoculated in Pasteur's laboratory—including the date of inoculation and of death. Following this comes a tabulated statement of the rabbits which have been inoculated in the regular way by trephining for the purpose of carrying on the virus and of observing the manner of symptoms resulting from such inoculations. The first column gives the number of the rabbits in this table; the second column (in Roman numerals) shows the number, as it stands in the original notes, of the animal from which the virus was taken; the third, fourth, and fifth columns explain themselves.

TABLE I.

First rabbit inoculated in Paris, June 19 or 20, 1886. Dead June 28th. Received July 2d.

Second rabbit inoculated in Paris, June 21st. Received July 2d. Died July 4th.

All of the inoculations given below were done by trephining.

No.	Inoculated from	Date of inoculation.	Appearance of symptoms.	Date of death.
1	I.	July 2, 1886.	July 14, 1886.	July 20, 1886.
2	I.	“ 2, “	“ 14, “	“ 19, “
3	II.	“ 5, “	“ 28, “	August 2, “
4	II.	“ 5, “	“ 14, “	July 20, “
5	VI.	“ 20, “	“ 29, “	August 2, “
6	VI.	“ 20, “	“ 29, “	“ 6, “
7	V.	August 25, “	Sept. 2, “	September 7, “
8	V.	“ 25, “	“ 2, “	“ 12, “
9	XI.	Sept. 7, “	“ 13, “ (bites.) “ 14, “ (paralysis.)	“ 20, “
10	XI.	“ 7, “	“ 13, “ (bites.) “ 28, “ (paralysis.)	October 2, “
11	XIII.	“ 22, “	“ 29, “	“ 3, “
12	XIII.	“ 24, “	October 4, “	“ 7, “
13	XVI.	October 4, “	“ 11, “	“ 16, “
14	Guinea-pig, II.	“ 11, “	“ 17, “	“ 24, “
15	Guinea-pig, II.	“ 11, “	“ 14, “	“ 22, “
16	XXI.	“ 18, “	“ 27, “	November 1, “
17	XXI.	“ 18, “	“ 25, “	October 30, “
18	XXI.	“ 18, “	“ 24, “	“ 30, “
19	XXI.	“ 18, “	“ 27, “	November 1, “
20	XXIV.	“ 22, “	“ 30, “ (very sluggish.) November 1, “ (paralysis.)	“ 8, “
21	XXIII.	“ 29, “	“ 5, “	“ 10, “
22	XXX.	Nov. 3, “	“ 19, “	“ 21, “
23	XXIX.	“ 5, “	“ 13, “	“ 17, “
24	XLII.	“ 17, “	“ 24, “	December 1, “
25	Dog, V.	“ 26, “	Decemb'r 3, “	“ 10, “
26	Dog, V.	“ 26, “	“ 3, “	“ 9, “
27	LXXIII.	Dec. 10, “	“ 17, “	“ 27, “
28	LXXIII.	“ 10, “	“ 17, “	“ 24, “
29	LXXV.	“ 24, “	“ 30, “	January 3, 1887.
30	LXXVI.	“ 24, “	“ 31, “	“ 6, “
31	LXXVIII.	January 8, 1887.	January 17, 1887.	“ 22, “
32	LXXVIII.	“ 8, “	“ 16, “	“ 22, “

TABLE II.

Statistics from the trephined rabbits in Table I.

No.	Time from the inoculation to the appearance of symptoms.	Time from the appearance of symptoms to death.	Time from the inoculation to death.
1	12 days.	6 days.	18 days.
2	12 “	5 “	17 “
3	23 “	5 “	28 “
4	9 “	6 “	15 “
5	9 “	4 “	13 “
6	9 “	8 “	17 “
7	8 “	5 “	13 “
8	8 “	10 “	18 “
9	6 “	7 “	13 “
10	6 “	19 “	25 “
11	7 “	4 “	11 “
12	10 “	3 “	13 “
13	7 “	5 “	12 “
14	6 “	7 “	13 “
15	3 “	8 “	11 “
16	9 “	5 “	14 “
17	7 “	5 “	12 “
18	6 “	6 “	12 “
19	9 “	5 “	14 “
20	8 “	9 “	17 “
21	7 “	5 “	12 “
22	16 “	2 “	18 “
23	8 “	4 “	12 “
24	7 “	7 “	14 “
25	7 “	7 “	14 “
26	11 “	6 “	17 “
27	7 “	10 “	17 “
28	7 “	7 “	14 “
29	6 “	4 “	10 “
30	7 “	7 “	14 “
31	9 “	5 “	14 “
32	8 “	6 “	14 “

TABLE III.

Averages, etc., from Table II.

Shortest period of incubation after trephining	3 days.
Longest “ “ “ “	23 “
Average “ “ “ “	8.6 “
Shortest period from the appearance of symptoms to death	2 “
Longest “ “ “ “ “	19 “
Average “ “ “ “ “	6.4 “
Shortest period from inoculation to death	10 “
Longest “ “ “	28 “
Average “ “ “	14.9 “

From these tables it may be seen, *first*, that, by inoculating animals —rabbits—in the way prescribed—*i. e.*, by trephining and injecting a small portion of an emulsion of a “rabid” cord under the meninges, certain symptoms occur after a period of incubation of varying duration, and that these symptoms are invariably followed by death. *Secondly*, that while the variation in length, of the period of incubation, and of the time from the appearance of the symptoms until death, varies considerably between individual cases, nevertheless the *average duration* of each of these periods corresponds very closely indeed with the figures given by Pasteur, and quite as closely as a so comparatively small number of experiments could be expected to do.

This correspondence of results is very interesting and important—furnishing, as it does, the first firm ground of belief which would induce a sceptic to go on with further investigations.

The *symptoms* found in all of these animals have been practically identical, so that a description of one case furnishes a picture of what occurred in all. After the operation of trephining and inoculation was completed, the animal would remain stupid from the effects of ether for from fifteen minutes to half an hour, but sometimes not even so long. The most successful operations are performed with practically no loss of blood. After the effects of the ether have passed, the rabbit is apparently as well and bright as ever, and certainly, if one may judge by its appetite, it suffers no shock or any other disturbance from the operation.

Seen at the time and for some days afterward, there is not the slightest sign of any event having occurred out of its ordinary experience. The first thing abnormal which usually makes its appearance, or which is noticed, is a slight weakness of the hind legs—a slight unsteadiness as the animal jumps from one side of the cage to the other. This unsteadiness very often disappears entirely, if the animal be forced to make three or four jumps; it is as if a little stiffness or lameness were removed by exercise. This weakness sometimes makes its appearance suddenly, being very marked in animals which fifteen minutes before were seen to be perfectly strong, so far as close scrutiny could detect.

Before this beginning paralysis can be detected, there is, occasionally, a decided change in the character of the animal; from being lively and affectionate it becomes dull and sluggish, and even fierce—if such a term may be applied to a rabbit; in the latter case it will jump at and bite objects held toward it, and may even growl and spit at them, showing every evidence of a desire to do harm. Such a condition as this is not common, however, and the first symptom which makes a decided impression upon the observer is, usually, that of the unsteadiness of the hind legs already spoken of. This paralysis of the hind legs is progressive in intensity and in character. It passes from the posterior extremities to the anterior, and increases until, at last, the animal lies upon its side entirely unable to move. It is, distinctly, a loss of motor power; reflex action remains until life is actually extinct. The power of deglutition is lost in twenty-four or more hours from the first appearance of any symptoms—and it was at one time supposed that death was caused by starvation. This can hardly be the case, however, inasmuch as the stomach is always full of partially digested food, and the tissues are not sufficiently wasted to warrant the supposition. Opisthotonos is early marked, and continues in an extreme degree after life is extinct. Before the paralysis has progressed so far that no motion is possible—there is at times a very considerable degree of restlessness—the animal struggles laboriously from one side of the cage to the other, without apparent object, falling over at almost every step. Just before death, there seems to be a revival of the powers—as manifested by a renewal of these struggles;—these movements disappear, absolute quiet ensues, and death occurs so easily that it is oftentimes impossible to tell whether life is or is not extinct. Whilst the symptoms last, the pulse, respiration, and temperature vary in an extreme degree, from very low to very high, and *vice versâ;* the variations being entirely without rhythm or symmetry, and apparently coinciding somewhat with the amount of muscular effort the animal may be making at the time. There is never any diarrhœa, no increase in salivary secretion, and no constant or peculiar change in the appearance of the mucus membrane of the mouth or fauces.

These are the appearances which have been presented in every animal recorded in this paper; not only in those which have been inoculated by trephining, but also in those which have succumbed to subcutaneous injection.

The appearances seen upon post-mortem examination are as uniform as are the symptoms which precede death; and, again, a description of one animal is practically a description of all. Naturally, the point of inoculation and the nervous tissues are the objects of greatest interest. If the inoculation has been by subcutaneous injection, the puncture through the skin may sometimes be made out by the presence of a minute spot of pigmentation, but there is never any sign of a local disturbance. If trephining has been performed, there is sometimes to be seen a very slight elevation of the brain substance under the point in the skull from which the button of bone has been removed. This is as often absent as present, but might be expected to occur by reason of the lack of the usual pressure at the point where the bone has been disturbed. There is never to be seen any sign of suppuration at the point of inoculation, or, for that matter, anywhere else; nor is there any other indication of a local disturbance. In *all cases*, however, whether the inoculation has been by trephining or by subcutaneous injection, the removal of the calvarium shows a congested condition of the membranes of the brain, without, however, any adhesive inflammation of the meninges. The cerebral sinuses are full of dark, clotted blood, but beyond this there is nothing to be seen in the brain. The brain substance is normal in color and consistency, and there are no spots indicating hemorrhage or emboli. The same conditions hold upon laying bare the spinal cord. The vessels of its membranes are sufficiently congested to give it a pinkish look, which disappears almost entirely when these membranes are removed, and the cord itself presents to the eye almost precisely the glistening white appearance of that of an animal which has been killed by chloroform or ether. In this case, as in the brain, the color and consistency are normal. (It has seemed to me as if there was more congestion in the venous sinuses of the cord membranes in the sacral, lower dorsal, and cervical regions; whether this is accounted for by the anatomical structures of the parts, I am not sufficiently skilled in comparative anatomy to decide.)

The internal organs of the thorax and abdomen present nothing unusual. The heart is always full of dark blood, and has ceased beating in diastole. The lungs are healthy in appearance, of a bright red color, and sometimes show localized spots of a dark red, which are situated on the side upon which the animal was lying when it died. The stomach is usually full of half-digested food, and occasionally shows spots of post-mortem digestion, along the greater curvature for the most part. There is not any marked congestion of its mucous membrane. The small intestine is empty; the rectum full of well-formed normal feces; the bladder is sometimes enormously distended with a clear, amber-colored urine of a low specific gravity and alkaline reaction; at other times it contains a moderate amount of fluid, with a very heavy deposit. A sample analysis by Drs. Wood and Harrington, of the Harvard Medical School, is as follows: Sp. gr. 1.036; reaction very acid; sediment excessive; albumen 0; sediment: amorphous urates, acid urate of sodium, spermatozoa, and mucous casts, some of which were evidently from the kidneys.

The kidneys are normal in appearance; the liver and spleen are sometimes full of blood, and, rarely, somewhat anæmic; the vessels of the mesentery and of the skin are always full of blood, so that the smallest branches may be easily traced.

In none of the animals upon which post-mortem examinations have been made has there been noticed the extreme degree of congestion of the internal organs upon which so much stress has been laid. The absence of this appearance is at least in part readily explained. The animals here spoken of were, during the whole time they were under observation, kept isolated and free from any disturbance whatever, so that no excitement other than that incidental to the disease was produced. On the other hand, clinically speaking, the instant an animal is suspected of rabies it is persecuted and chased from one corner to another, until, unless frightened to death, it is put out of existence by clubs and stones. Under such conditions as these, congestion and even hemorrhage of the internal organs are but the natural result. The absence of the classic "period of excitement" in so many of the animals here recorded may very probably be ascribed to the same circumstances of quiet surroundings and freedom from annoyance. This "period of excitement" is all that makes the difference in the books between the "furious" and the "dumb" forms of rabies. It precedes the appearance of paralysis, if it occurs at all, and is always terminated by the paralysis.

Taking into consideration the condition of things as it must be in the brain and cord, with each individual cell struggling against some foreign element, it is not difficult to understand how easily these disturbed cells may send various messages to the muscles, and how easily these messages may result in manifestations of excitement. From such a point of view, it is hardly rational to consider the "furious stage" as anything more than a chance appearance in the course of rabies, the likelihood of its presence being diminished as those things tending to excitement are taken away.

In order not to give any ground for the criticism that the results in this paper are too favorable, and in order not to claim too great perfection for the operator's skill, every animal used in this investigation will be spoken of, and where a variation from the results expected has occurred, the explanation, if there is any, will be given in accordance with the facts observed.

The first series of experiments which comes under this head is that which includes those rabbits which were meant to show the usual symptoms—were inoculated for that purpose—and yet failed to do so. These experiments will be found in the following table:

Table IV.

No.	Date and method of inoculation.	Result and explanation.
1	Inoculated by trephining, Sept. 22, 1886.	Dead, September 23. Blood-clot on brain. Injury to longitudinal sinus.
2	Inoculated by trephining, Sept. 24, 1886.	No symptoms. Killed Dec. 21, 1886. Dura mater not pierced by syringe needle, and virus washed out.
3	Inoculated by trephining, Oct. 4, 1886.	Savage Oct. 13 to 23, then no signs. Killed on December 21, 1886. Virus partially destroyed (attenuated) by heating.
4	Inoculated by trephining, Oct. 22, 1886.	Sluggish Oct. 30; savage Nov. 5; no signs on 7th. Killed Dec. 22. Virus partially destroyed by heating (attenuated).
5	Inoculated by trephining, Oct. 29, 1886.	Slight paresis Nov. 6; none on 7th; savage 10th to 14th. Killed Dec. 22, 1886. Virus attenuated by heating.
6	Inoculated by trephining, Nov. 3, 1886.	No signs. Killed December 23, 1886. Virus destroyed by heating.
7	Inoculated by trephining, Nov. 5, 1886.	Sluggish on 14th and 15th, then well. Killed December 23, 1886. Virus attenuated by heating.
8	Inoculated by trephining, Nov. 17, 1886.	No signs thus far, January 25, 1887. In this case syringe leaked, and it is doubtful if any of the material was introduced.

Thus it appears that there are eight animals which may be counted as failures; that is to say, the results were not as they were intended to be. Of three, the note appended to Nos. 1, 2, and 8, explains itself; of the others, Nos. 3 to 7, it is stated that the virus was more or less affected by heating in all of them, and this needs a little explanation. The way in which this mistake—for it was one in these cases—occurred, was as follows: It was not always possible to use the animals for inoculation immediately after death, and where this was the case, the bodies were at once frozen to prevent any change. In preparing some of these animals for use they were placed, by a mistaken idea of an assistant, in the *steam sterilizer* in order to hasten the thawing process. The heating was carried too far, and, as a result, the strength of the virus was diminished or destroyed entirely. This table, therefore, does not in the least weaken the force of the first one, but rather seems to show what may happen even when the operator himself takes all the precautions required. The cases where the heating of the animals occurred are also of value, as showing how readily a rise of temperature affects the virus in the cords.

This point will be found illustrated further on by experiments purposely made to test it.

Passing from obtaining such systematic results as are detailed in Table I., the questions arise, How does a variation of the inoculating material influence the result? Does a change in the fluid used produce a change in the symptoms, or are these symptoms simply the result of the introduction of any foreign substance under the meninges of the brain? This point, put in the form of the broad assertion, that nothing but this virus will produce these symptoms, would have to be supported by a very large series of experiments, and this has not been attempted. That variations, or rather a non-appearance of the symptoms, may be the result of changes in the material introduced, is well shown in the accompanying summary.

TABLE V.

Control experiments upon rabbits.

No.	Date of inoculation.	Method and material used.	Result.
1	Aug. 2, 1886.	By trephining. Virus heated 5 m. to 110° F.	No symptoms. Well, January 28, 1887.
2	Aug. 2, 1886.	The same.	No symptoms. Well, January 28, 1887.
3	Sept. 24, 1886.	By trephining. Bouillon and water without any cord.	No symptoms. Well, January 28, 1887.
4	Sept. 24, 1886.	The same.	No symptoms. Well, January 28, 1887.

No.	Date of inoculation.	Method and material used.	Result.
5	Oct. 11, 1886.	By trephining. Emulsion of cord dried at 20° C. for ten days.	Very slight paresis, October 20th and 21st. Well, January 28, 1887.
6	Oct. 11, 1886.	The same.	Very slight paresis, October 21st. Well, January 28, 1887.
7	Oct. 19, 1886.	By trephining. Emulsion of cord of healthy rabbit.	No symptoms. Well, January 28, 1887.
8	Oct. 19, 1886.	The same.	Died *suddenly*, Nov. 19, 1886. Liver stuffed full of coccidium oviforme nodules.
9	Oct. 19, 1886.	The same.	Died *suddenly*, Nov. 7, 1886. Liver stuffed full of coccidium oviforme nodules.
10	Oct. 19, 1886.	The same.	No symptoms. Well, January 28, 1887.

The results here tabulated show that in every instance—other conditions being exactly the same—of inoculation by trephining with material different from the usual emulsion of the cord of an animal dead with the paralytic symptoms, nothing occurred which could by any possibility be ascribed to the inoculations except twice. The two cases where slight paresis was observed (5 and 6) only indicate that the strength of the virus was diminished by the drying of the cord used. The two cases in which death occurred (8 and 9) showed absolutely none of the regular signs; there was no change in disposition, no paralysis, no period of incubation, and the post-mortem examination showed the presence of enormous numbers of what looked like miliary tubercles with a few small abscesses. These changes were confined to the liver in both cases. Upon microscopic examination these nodules were found to be *not* produced by tuberculosis, but by the "coccidium oviforme"—a parasite not uncommon in rabbits. (Leuckart, *Parasites of Man*, 1886, p. 203, *et. seq.*)

These results, together with all the others mentioned in this paper, teach us that suppuration is not only not a necessary accompaniment of inoculations after Pasteur's method, but that the moment suppuration appears the experiment is vitiated, so far as proving or disproving anything of Pasteur's assertions is concerned. This is of special importance in connection with Spitzka's paper published in *The Journal of Comparative Medicine and Surgery* for July, 1886, under the title of "How Can We Prevent False Hydrophobia." This author distinctly states that he does not wish to touch upon the question of the existence of such a disease as true rabies, but, at the same time, his authority is quoted, as well as his experiments, to prove that there is no such thing, and, *especially*, that any putrescible substance will produce regularly, after a period of incubation, the paralytic symptoms claimed to arise from a specific virus. Surely there is nothing in six experiments, incompletely reported, to warrant such an assertion. In the account of the autopsies, only two are given; *purulent meningitis* was found in one case, and *inflammatory red softening* of great extent in the other, together with, in this latter case, a blood-clot, and congestion and tumefaction of the hemisphere on the side upon which the operation was performed! Of course, if any results whatever are to be quoted as arguments in such a case as this, and if symptoms due to any sort of injury to the brain with results differing entirely from those of Pasteur are to be considered as disproving the occurrence of uniform results and pathological appearances, discussion is useless.

Still more striking than any of the results already detailed, were a series of experiments made upon guinea-pigs. These experiments were additional control work, to determine the *specific* nature of the virus employed, and the results obtained, in view of work done at other times, are exceedingly emphatic. An emulsion of the cord and medulla of a rabbit dead with the usual symptoms was prepared in the usual way, and three minims of the solution were injected subcutaneously in the right groin of the full-grown, healthy guinea-pigs. The usual precautions against contamination were taken, and the results are given in the following table.

Table VI.

Subcutaneous inoculation of guinea-pigs.

No.	Date of inoculation.	Date of appearance of symptoms.	Result.
1	Sept. 22, 1886.	Sluggish, and slight paresis, October 11th to 16th. Well on 17th.	No symptoms from October 17th. Killed December 27th. No changes.
2	Sept. 22, 1886.	Paresis October 9th.	Dead Oct. 10th. Usual congestion of membranes of cord.
3	Sept. 22, 1886.	No symptoms.	Killed Dec. 27th. No changes.
4	Sept. 22, 1886.	Paresis October 13th.	Dead Oct. 16th. Usual congestion of membranes of brain and cord.
5	Sept. 22, 1886.	No symptoms.	Killed Dec. 27th. No changes.
6	Sept. 22, 1886.	No symptoms.	Killed Dec. 27th. No changes.
7	Sept. 22, 1886.	No symptoms.	Killed Dec. 29th. No changes.
8	Sept. 22, 1886.	No symptoms.	Killed Dec. 29th. No changes.
9	Sept. 22, 1886.	Paresis October 9th.	Dead Oct. 3d. Usual congestion of membranes of brain and cord.
10	Sept. 22, 1886.	No symptoms.	Killed Dec. 29th. No changes.

Here it may be seen, that in four out of the ten animals inoculated symptoms made their appearance which could be referred only to a disturbance of the nervous centres, and in three of these four animals the appearance of the symptoms was followed by an increase in their severity and extent with a fatal termination. This result is especially striking in view of the fact that in other experiments a very large number of inoculations have been made with all kinds of pathogenic and non-pathogenic bacteria, in the same way, and in the same species of animal, and yet the writer has never seen any result like that here recorded. Lesions extending from a miliary abscess at the point of inoculation to a general septicæmic or tuberculous process have been obtained, but never under any circumstances anything which seemed in the least like a disturbance of the nervous centres. To a practical bacteriologist, therefore, the results given in the preceding table are especially convincing. In no case was there the slightest indication of a local disturbance at the point of inoculation; the skin was as if it had never been touched, so much so, that recourse to the record was necessary to determine where the inoculation had been made.

As a further proof that the symptoms observed in the dead guinea-pigs were in reality due to the same cause as was producing similar conditions in rabbits all the time, the cord of one of the animals was removed, beaten up with distilled water and bouillon in the usual way, and inoculated by trephining into two rabbits. The result was confirmatory, the two animals showing the usual symptoms; the appearance of weakness of the hind legs increasing to general paralysis followed by death. These results are tabulated below.

TABLE VII.

Test of cord of guinea-pig upon rabbits.

No.	Date and method of inoculation.	Appearance of symptoms.	Result.
1	By trephining. Oct. 11, 1886.	Symptoms of paresis Dec. 12th.	Death Oct. 24th, with the usual appearances in membranes of brain and cord.
2	By trephining. Oct. 11, 1886.	Sluggish on 14th, paresis on 15th.	Death Oct. 22d, with the usual appearances in membranes of brain and cord.

Of course, no such investigation as the present would be complete unless observations were also made upon dogs. These animals were used, but not to anything like the same extent as rabbits, for the reason that the behavior of the "specific virus" in rabbits is the point upon which the greatest stress is laid and upon which so much depends. In the dogs experimented upon, the conditions were made precisely the same as obtained in the work upon rabbits. The instruments were sterilized with the same regularity, the operations were performed in the same way, and the material used for inoculation was, as in the other cases, an emulsion of the brain and cord of an animal previously inoculated with similar material. Another reason for not making more numerous experiments upon dogs is the fact that in every case in which the conditions of a successful inoculation have been fulfilled, the result has been the same, the production of identically the same symptoms in dogs as have always appeared in rabbits treated in the same way; these symptoms coming on after a "period of incubation" extending over from eight to twelve days, then increasing in severity, and finally terminating in death.

The result of these experiments upon dogs is given in the accompanying table:

TABLE VIII.

Inoculation experiments upon dogs.

No.	Manner and date of inoculation.	Symptoms appeared.	Result.
1	By trephining. Nov. 9, 1886.	Paresis, Nov. 21st.	Dead, Nov. 25, 1886.
2	By trephining. Dec. 10, 1886.	Paresis, Dec. 20th.	Dead, Dec. 26, 1886.
3	By trephining. Dec. 10, 1886.	Paresis, Dec. 20th.	Dead, Dec. 26, 1886.
4	By trephining. Dec. 15, 1886.	Paresis, Dec. 20th.	Dead, Dec. 27, 1886.
5	By trephining. Dec. 15, 1886.	Dilated pupils, Dec. 24th; paresis, Dec. 26th.	Dead, Dec. 30, 1886.

In order to be sure of the virus, the cord of one of these dogs was tested by inoculating into rabbits, with the production of the usual symptoms; the rabbits were trephined and inoculated in the usual way; the paralysis made its appearance at the usual time, spread in the usual way, and ended fatally, as usual. The results are given in Table IX.

TABLE IX.

Test of cord of dogs upon rabbits.

No.	Date and method of inoculation.	Symptoms appeared.	Result.
1	Trephined, Nov. 26th.	Symptoms. Dec. 3d.	Death, Dec. 10th.
2	Trephined, Nov. 26th.	Symptoms. Dec. 3d.	Death, Dec. 9th.

This is but a small number of experiments, taken by themselves their exact correspondence with those made upon other animals is thei essential value. In every case, not only were the symptoms durin life the same as those observed in rabbits and guinea-pigs, but the appearance upon post-mortem examination was the same, with the single exception that the stomach was entirely empty, except in two cases, in whic a small amount of *hair* was found. (In rabbits the stomachs wer always full, although this cannot be said to mean much after all, i the face of the assertion of physiologists that one can never empty rabbit's stomach, even by prolonged starvation.) In none of the dogs were there any prolonged periods of excitement or fury seen; such a condition as the "furious" stage was entirely absent. They were all subject to short fits of restlessness, during which they moved quickly and aimlessly from one side of the cage to the other. At these times they would occasionally cry out, and sometimes would appear as if in extreme pain; shortly afterward they would sink into a sort of lethargic state, from which it was extremely difficult to rouse them. To what extent these short periods of restlessness would have been extended if the animals had been at large, and how near they would have approached the classic "fury" of a rabid dog, it is, of course, impossible to say. As a matter of fact, the dogs were kept confined and entirely protected from any but the most necessary disturbance, and any alienist has daily experience of the sedative effect of quiet and seclusion upon his patients. In only one case was there any marked desire to bite, and that was only manifested after the animal had been disturbed, as would naturally be the case at any time with a dog sick of any disease. The membranes of the brain and cord were always congested, but there were no localized symptoms at the point of inoculation, nor any greater disturbance on the side where the inoculation had been made; most important of all, there was not the slightest indication of any suppuration.

Before concluding this part of the paper, which has had for its object the determination of the existence of the specific virus called that of rabies, the same thing is to be done here as in the case of the rabbits—the unexpected results and failures in the inoculation of dogs must be recorded. This is done in Table X.

TABLE X.

Failures of inoculations upon dogs.

No.	Date and method of inoculation.	Symptoms appeared.	Result.
1	Subcutaneous injection, Sept. 7, 1886.	No symptoms.	Killed Dec. 10th. No changes.
2	Subcutaneous injection, Sept. 7, 1886.	No symptoms.	Killed Dec. 10th. No changes.
3	Trephined, Oct. 29, 1886.	Symptoms, Nov. 4, 1886.	Dead Nov. 11th. Compression of brain by blood-clot.
4	Trephined, Dec. 10, 1886.	Symptoms, Dec. 11, 1886.	Dead Dec. 13th. Brain injured by trephine; spot of softening about point of injury.

The first two of these animals were inoculated by subcutaneous injection; after being kept under observation for three months they were killed, as no symptoms had appeared. The last two cases explain themselves: in the first, the longitudinal sinus was pierced, and in the second the trephine slipped during the operation and entered the brain, the result being the same as would occur in any other such injury.

The work already recorded seems to show pretty definitely, that there is a specific virus contained in the cords of rabbits inoculated with the material and in the way spoken of by Pasteur. This point having been settled, the question arises, Is it true that by certain procedures this virus can be diminished in strength, and can animals be protected from an attack of rabies after inoculation with that disease by the method suggested by Pasteur—in other words, does "protection" protect? The remainder of the work done in this investigation has been completed with the object of illustrating this point.

The principle of "protective inoculation" is drawn from these facts: That the cord of an animal dead of rabies, if promptly removed and kept at an even temperature (20° C.), and in a dry atmosphere, will gradually lose its virulence, so that, at the end of ten or twelve days, this virulence will be entirely gone; and that this loss of virulence is gradual and progressive, *not* sudden. The *theory* is, that by injections on successive days, of emulsions of cords of increasing virulence, an immunity is established against an attack of the real disease, or, what is the same thing, against an inoculation with the strongest virus, and that this "immunity" is established whether the inoculation, or bite, occurs before, or after, the protective measures are taken. As a corollary, it follows, of course, that if the inoculation, or bite, occurs before protection, the protection, to be effective, must be completed before the period of incubation of the disease has passed; that is to say, before any deep impression has been made upon the nervous centres.

For the purpose of protective inoculation, cords are to be removed immediately after death with all possible precautions against contamination. They are then suspended in sterilized jars, stoppered with cotton-wool, and containing some hygroscopic material to promote the absorption of moisture. The jars are kept in a dry chamber, as nearly as possible at a temperature of 20° C., and portions of the cords they contain are used for injection as occasion requires,—the cords being made into an emulsion in the usual way. This is the method; but to have everything ready for a protective inoculation at any given time, some calculation is necessary, and a number of rabbits must have been inoculated, so that they will die on the day that it is necessary to begin drying the cords, so that these cords shall be of the proper intensity of virus on the days they are needed. This, for a single series of protective inoculations, when it is known at what date the protection must begin. If the desire is to be ready to perform these protective inoculations at any time, a little reflection will show that rabbits must be inoculated every day, at least one must die every day, and that the cord must be removed and the drying begun every day. Of course, such work as this can be carried out only at the expense of much time, labor, and money, and it appears at once how much more easy it is to condemn the method by the facility with which inaccurate results may be obtained, than it is to test its merits thoroughly by exact observation.

In the work detailed below, the first procedure was preparing the rabbits so that the inoculations with the strong virus could be made upon the 10th of November, 1886, and the protective inoculations could be begun upon the following day. What was done may be thus tabulated: Rabbits had been previously inoculated so that it was possible on

Table XI.

Nov. 1.	To prepare a cord for use on	11th	(10 days).	
“ 3.	“ “ “	12th	(9 days).	
“ 5.	“ “ “	13th	(8 days).	
“ 7.	“ “ “	14th	(7 days).	
“ 9.	“ “ “	15th	(6 days).	
“ 10.	Rabbits were inoculated with virus of full strength and protection begun.			
“ 11.	With cord of	1st	(10 days drying)	and cord prepared for use on 16th [5 days.
“ 12.	“	3d	(9 “)	
“ 13.	“	5th	(8 “)	and cord prepared for use on 17th [4 days.
“ 14.	“	7th	(7 “)	
“ 15.	“	9th	(6 “)	and cord prepared for use on 18th [3 days.
“ 16.	“	11th	(5 “)	
“ 17.	“	13th	(4 “)	and cord prepared for use on 19th [2 days.
“ 18.	“	15th	(3 “)	
“ 19.	“	17th	(2 “)	and cord prepared for use on 20th [1 day.
“ 20.	“	19th	(1 “)	and protective inoculation was completed upon this day, the 20th.

The value of this method of procedure was tested upon four series of rabbits in four different ways: *First*, by the subcutaneous injection of virus of the strongest quality, and the following of this on successive days for ten days by the subcutaneous injection of virus of progressively increasing strength, as shown in the preceding table; *second*, by carrying out the protective measures, as above, first, and then injecting the strong virus; *third*, by inoculation with the strong virus first, *by trephining*, and then protecting by subcutaneous injection on ten successive days; *fourth*, by protection first by subcutaneous injection, and then inoculation with the strong virus *by trephining*.

The first test is unquestionably the most important and its results are especially striking, for the reasons that the conditions observed approach nearest to what occurs in real life, and because it is against such subcutaneous inoculation—by bites—that the protective measures are adopted in human beings. The results of the test in regard to the first point are given in the following table:

TABLE XII.

Protective inoculations in rabbits—1. By subcutaneous injection; inoculation first, and then protection.

No.	Date and method of inoculation.	Protective injections.	Result.
1	Nov. 10, 1886. Subcutaneous injection.	Protected Nov. 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, with cord 10, 9, 8, 7, 6, 5, 4, 3, 2, and 1 day old respectively.	No symptoms. Well Jan. 30, 1887.
2	The same.	The same.	The same.
3	The same.	The same.	The same.
4	The same.	The same.	The same.
5	The same.	The same.	The same.
6	The same.	The same.	The same.
7	The same.	The same.	The same.
8	The same.	The same.	The same.
9	The same.	The same. Symptoms Nov. 24.	The same. Dead Nov. 28.

At the same time that these animals were inoculated, a second series was treated in the same way, and with the same virus, and left unprotected, as seen below.

TABLE XIII.

Control of virus used in Table XII. Subcutaneous injection of rabbits, without subsequent protection.

No.	Date and method of inoculation.	Symptoms.	Result.
1	Nov. 10, 1886. Subcutaneous injection.	No symptoms.	Well Jan. 30, 1887.
2	The same.	Symptoms Jan. 8, 1887, paresis.	Dead Jan. 12, 1887.
3	The same.	Symptoms Nov. 23, paresis.	Dead Nov. 27, 1886.
4	The same.	Symptoms: Fierce on Nov. 22; paresis on Nov. 27, 1886.	Dead Nov. 30, 1886.
5	The same.	Symptoms: Fierce on Nov. 28 to Dec. 8; paresis Dec. 8.	Dead Dec. 13, 1886.
6	The same.	Symptoms of paresis Nov. 27.	Dead Nov. 30, 1886.
7	The same.	Symptoms of paresis Dec. 3.	Dead Dec. 8, 1886.
8	The same.	No symptoms.	Well Jan. 30, 1887.
9	The same.	Symptoms of paresis Dec. 3.	Dead Dec. 7, 1886.

These two tables present a very strong contrast: upon the first, one death is recorded; and upon the second seven are noted. In the first case, the symptoms appeared on the fourth day after the protective injections were completed, and it is perfectly justifiable to suppose that in this case the period of incubation of the original inoculation was too short to permit the protective measures adopted to take full effect. On the other hand, the seven deaths recorded on Table XIII., out of nine rabbits, inoculated and left unprotected, show that the virus used was possessed of great active properties, and the inference is warrantable that some influence for good was exerted by the measures adopted in the first series, subsequent to the injection of the strong virus. The symptoms of the rabbits which were affected were the same in all cases, and these and the gross pathological appearances correspond exactly with those already detailed, as seen in the rabbits in Table I.

The results of testing the protective injections in the three other ways spoken of, are given below in Tables XIV., XV., XVI., and XVII.

TABLE XIV.

Protective inoculation in rabbits—2. By subcutaneous injection; protection first, and inoculation with strong virus.

No.	Protected.	Inoculated.	Result.
1	Nov. 11 to 20, with cords 10 to 1 day old.	Subcutaneous injection with strong virus, Nov. 29, 1886.	No symptoms. Well Jan. 30, 1887.
2	The same.	The same.	The same.

TABLE XV.

Protective inoculations in rabbits—3. Inoculation by trephining; inoculation first, and then protection.

No.	Date and method of inoculation.	Protected.	Symptoms.	Result.
1	Nov. 10, 1886. By trephining.	Protected Nov. 11 to 20, with cords 10 to 1 day old.	Paresis appeared Nov. 20.	Dead Nov 25.
2	The same.	The same.	Paresis appeared Nov. 21st.	Dead Nov. 25.
3	The same.	The same.	None.	Well Jan. 30, 1887.
4	The same.	The same.	Sluggish from Nov. 21 to 24, then well.	Well Jan. 30, 1887.

TABLE XVI.

Protective inoculations in rabbits—4. By trephining; protection first, then inoculation with strong virus by trephining.

No.	Protected.	Inoculated.	Result.
1	Nov. 11 to 20 with cord 10 to 1 day old.	Nov. 29 with strong virus, by trephining.	Sluggish Dec. 8; fierce to Jan. 1, 1887; well Jan. 30, 1887.
2	The same.	The same.	Paresis Dec. 7; dead Dec. 11.

TABLE XVII.

Attempted control of strength of virus used in Tables XV. and XVI. Rabbits.

No.	Inoculated.	Result.
1	By trephining. Nov. 29, 1886.	No symptoms. Well January 30, 1887. (Syringe leaked badly during operation, and considerable hemorrhage occurred; probably no virus injected.)
2	The same.	Well January 30, 1887. (Longitudinal sinus opened during operation; enormous hemorrhage, and virus probably washed out.)

A study of these tables shows that no symptoms whatever occurred when the protection preceded the inoculation of the strong virus (Table

XIV.), this inoculation being made by subcutaneous injection nine days after the protective measures were completed. In Tables XV. and XVI., where the inoculation with the strong virus was made by trephining, there is recorded a loss of half the animals, when the protection preceded the inoculation, as well as when it followed it. These results are not as fatal as those of Frisch, of Vienna (*Wien. med. Presse*, Nos. 31 and 32, 1886), and, in any case, the objection that this is an unjustly severe test of the method is a valid one, the inoculations by trephining bringing the virus in immediate contact with its place of election, and not allowing for the longer period of incubation which follows a subcutaneous inoculation (bite), against which method of inoculation the preventive injections are directed.

The last table (XVII.) gives the result of two inoculations by trephining, made to test the strength of the material used in the experiments recorded in Tables XV. and XVI. They were both failures—the result being undoubtedly due to the imperfect operation, which latter was caused by haste, owing to pressure of other work. That the virus was of the full strength is shown by the results in Tables XV. and XVI., and also by the symptoms in the animal from which it was taken, and in other animals inoculated with it to carry on the virus.

The work above recorded is what has been done to prove the three propositions:

(1) Is there a specific virus in the brains and cords of rabbits inoculated with Pasteur's material and after his methods?

(2) Does the treatment by drying, proposed by him, modify the strength of this virus? And, finally,

(3) Does injection with such "modified virus" produce an immunity against an inoculation (or bite) with virus of full strength?

The experiments have been given in detail, and, with the utmost frankness, every animal experimented upon has been spoken of, and absolutely nothing has been concealed. The writer began the investigation as a sceptic—as a disbeliever in the existence of a virus which would produce such peculiar symptoms as were claimed; he had not visited Pasteur, was ignorant of his precise methods, and knew nothing more of his results than he has seen fit to publish.

The results of the work here given must speak for themselves: they certainly seem to justify a change from scepticism, complete and absolute, to a belief in, at least, a portion of Pasteur's assertions. Whether the virus used in these experiments is the virus of true rabies or not is a point which cannot be settled until an opportunity is offered for investigation of the result of inoculations with material from a fresh case of rabies in a dog or other animal—*unless* such evidence has already been obtained in Pasteur's laboratory, and *published*. If the latter is the case such publication has escaped notice up to the date of finishing this paper.

Whether this is the true virus of rabies or not, it is something specific. It may be the true virus, or it may be the true virus altered in some degree by its long transmission from animal to animal, or it may be something entirely different and apart from the true virus; this is a point of mere scientific interest. The practical result is the same in either case, so far as concerns the application of the method to man. It is absurd to suppose that in a country like France, where rabies is so comparatively frequent, and in a series of cases so large and closely observed as that of Pasteur, a certain percentage, and that a large one, of the patients submitted to him, have not been bitten by rabid animals. This being true, even with the few deaths claimed and heralded as "failures," the percentage of fatal results among his cases is unquestionably much smaller than among those in which his method was not adopted.

Every one knows that now, in severe bites or lacerated wounds, more frequent, stronger, and repeated preventive injections are used than was the case at first. This change does not alter the *principle* of the method, however, and as it was that it was desired to test, the original *daily interval* injections were adopted in this research.

A discussion of the minute changes observed has been avoided. The study of the microscopical appearances of the various organs, especially of the brain and cord, together with the results of bacteriological research, form a part of the work by themselves. It is hoped that it may be possible to find something *specific* in this direction at some future time.

The conclusions which may be drawn from the work here recorded seem to be as follows:

I. There exists in the cords and brains of animals inoculated in Pasteur's laboratory a *specific virus*, capable of the production of similar symptoms through a long series of animals.

II. That these symptoms are produced with absolute certainty when the method of inoculation is by trephining the skull, and injection under the dura mater,—with less certainty when the inoculation is by subcutaneous injection.

III. That the strength of this virus is lessened when the cords containing it are removed from the animals and placed in a dry atmosphere at an even temperature.

IV. That the symptoms produced by the inoculation of this virus only appear after a certain period of incubation, distinctly shorter when the inoculation has been done by trephining, than when done by subcutaneous injection.

V. That injections of the virus, modified in strength by drying, and in the manner prescribed by Pasteur, exert a very marked protective influence against an inoculation with virus of full strength.

VI. That a very moderate degree of heat destroys the power of the virus entirely, whilst prolonged freezing does not injure it.

As will be seen, all of these conclusions are in complete accord with the declarations of Pasteur; their importance lies in the fact that they were reached at a distance from him, and by work entirely separated from any personal influence or bias.

The liberality of the Medical Faculty of Harvard University gave the necessary pecuniary support to this investigation. The energetic and persistent assistance of Mr. Austin Peters, M.R.C.V.S., permitted the completion of much of the work contained in it. Dr. Osgood's great trouble in obtaining and bringing the rabbits to this country, also deserves the author's most sincere thanks.

NOTE.—This paper was prepared for the press when the later results of von Frisch came under notice. The time to investigate the full paper was too short, and the summary as given in the *Medical Record* of January 22, 1887, was made use of. The conclusions to which he has come are precisely the same as those drawn from the work in this paper, so far as they cover the same ground. His further conclusions are based upon work done with virus obtained from street rabies, and seem to establish the identity between this and the experimental virus of Pasteur. His work has led him to the expression of a suspicion, already expressed by the writer in another place, that the intensive method of preventive treatment recently recommended by Pasteur, may very possibly produce the disease. Whether von Frisch is justified in his conclusions by a sufficient number of experiments upon which to base them, the writer cannot say at present; certainly the conclusions of his previous papers upon this subject were entirely too weighty for the foundation upon which they were built.

BOSTON, January 30, 1887.

A NOTE ON THE MEANS OF TOPOGRAPHICAL DIAGNOSIS OF FOCAL DISEASE AFFECTING THE SO-CALLED MOTOR REGION OF THE CEREBRAL CORTEX.

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THE necessity for exact knowledge of the relations between the external surface of the head and the various encephalic regions has arisen so rapidly within the last few years as to force each practical surgeon to work out the required facts for himself with the aid of the few papers that have appeared on the subject.

In the absence of any such desired comprehensive monograph giving a complete directory, as it were, of those parts of the brain whose function is so far understood as to admit of the localization of lesions within their boundaries, a personal experience, which has so far fortunately been equal to the exigencies of ten cases submitted to operation, may be of use to those who are similarly called upon to explore the cranial cavity.

This paper, therefore, professes to be nothing more than a summary of the means adopted by the writer as topographical guides to definite portions of the brain, and is not in any sense a review of what has hitherto been written in elucidation of the problem under discussion, although such writings in so far as they have rendered invaluable assistance will be referred to, viz., those by Hefftler, Broca, Féré, Lucas, Championnière, Reid, Hare, etc.

The localization of disease of the encephalon is obviously a two-sided process. First, the diagnosis of the seat of the disease in the nerve tissue, by observation of the symptomatic perversion of function; and, secondly, the determination of the particular part of the skull and soft parts covering the focus of disease.

The second part of the process has usually been separated from the first, and considered by itself, under the title of cerebral topography, and may, doubtless, with advantage be thus studied as a distinct subject; but it really is in closer connection with the other division, namely, cerebral localization, than may appear at first sight to the anatomist. The truth of this will be obvious at once upon consideration of the fact that cerebral topography, pure and simple, consists in a determination of the exact relation of the various sulci to the exterior, yielding, of course, invaluable and indispensable results; but, further, that a minute study of localization of function in the cerebrum shows that although these same sulci possess a fundamental value in the separation of areas possessing different functions, that such topographical division is not to be regarded as absolute and definitive. This fact, of course, in no wise militates against the general principles of cerebral localization, and it is, besides, only more specially true of those functions which are very largely represented in the nerve centres.

As an illustration of the truth of this general proposition, we may point to the mode of representation of the upper limb, as recently defined by Dr. Beevor and myself (following upon the lines laid down by Dr. Ferrier), from which it would appear that several and the same segments of the limb are represented in the cortex on both sides of the fissure of Rolando. Indeed, although fortunately the representation of function—*i. e.*, in this case movement—is exceedingly constant and clearly defined, yet the delimiting value of the various sulci has still to be determined, it being perfectly clear from the observation of examples, such as that just quoted, that mere physical characteristics, such as length, depth, etc., of a sulcus, heighten its value, not as a *boundary*, but as a *landmark* of function. In this way we shall subsequently find that, while always having to start an attempt to localize disease, by first determining the relative positions of the different sulci, the completion of the inquiry will only be accomplished by application of the knowledge of the concentration of the representation of any given function about certain points in those sulci.

It consequently follows that the localities in which different functions are represented are not separated by hard outlines (and this belief is also borne out by experiment), but that they occupy absolutely constant focal positions, and in this way will in the, let us hope, immediate future be very accurately mapped out. The above considerations also bring us back to the point we started from, viz., the close union of the representation of function and the topographical positions of the sulci, for the mapping out of the localities of function is only to be done by the accurate observation of experiments on the lower animals, and by the very rare opportunities of clinical observation in cases of very closely delimited disease.

The last-named method, viz., clinical observation of the effects of disease, furnishes but barren results, as may be seen, for instance, from the exceedingly slight advance which has been made by its means in our general knowledge of the pathology of new growths. On the other hand, the determination of the representation of cerebral function by means of experiments upon the brains of animals closely allied to man, has proved most fertile in the production of facts upon which very active treatment has been safely based. Indeed, we owe nearly all we know about the function of the different parts of the cortex cerebri to experiments upon the lower animals.

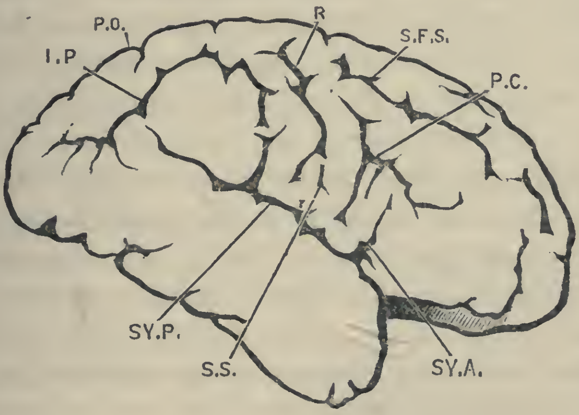
Fortunately, it is easy to establish the exact homologies between the parts possessing certain functions in the brains of the higher monkeys, and the like parts in the brains of men. The identity of the various localities of function is readily determined, and, speaking from the evidence at our present disposal, is fairly complete.

Localization in the Cerebrum of the Function of Movement of Different Parts of the Body.

The localization of the special sense functions in the human cortex cerebri is still a matter of such contention as regards minute detail that it would be unpractical to devote any part of the present paper to its consideration, and especially as from lack of immediate personal experience, all that could here be said on the point would be little more than a mere digest of monographs and collected works available to all neurologists. Such a digest, it need hardly be added, is altogether outside the original scope of this note. Limiting ourselves, therefore, to the subject of the representation of the function of movement, we will proceed at once to sketch the position of the various localities of such representation, according as they are known at the present day, bearing in mind the outlines and nomenclature of the sulci and gyri of the centre of the brain.

It would also be foreign to the subject of this paper if it included a very full description of the well-known anatomical details of the configuration, etc., of the cortex of the brain; but many important details must be referred to, and, for the sake of completeness of illustration and by way of preface, the reader is referred to the accompanying diagram, Fig. 1, which is traced from a photograph of the right hemisphere of an adult English woman. It may be advisable, moreover, to point out that, as the representation of one and the same function may extend over and beyond this or that sulcus, as has already been mentioned, it is advantageous mentally to subdivide this region into horizontal levels, for the variation in the representation of function will be found to be greatest in passing over the "motor" area from above down. In other words, the nature of the function of the convolution bordering the longitudinal fissure, is more different from the function of the convolution forming the upper edge of the Sylvian fissure, than is the function

FIG. 1.



P. O. Parieto-occipital fissure (external).
I. P. Intraparietal sulcus.
R. Fissure of Rolando.
S. F. S. Superior frontal sulcus.
P. C. Parietal sulcus.
Sy. A. Anterior limb of the Sylvian fissure.
Sy. P. Posterior limb of the Sylvian fissure.
S. S. Subordinate sulcus separating area of absolute adduction of vocal cords.

of the anterior third of the so-called motor region from the posterior third.

We may say, therefore, with perfect anatomical truth, that this great variation in representation from above down, and the slighter difference from before back, is correlated with the decrease in the size of the so-called motor corpuscles from the paracentral lobule downward, and their comparative constancy in volume in one and the same horizontal level.

It will thus be found convenient to conceive of the convex region, known popularly as the "motor area," as being subdivided nearly horizontally by imaginary extension backward of the superior and inferior frontal sulci, and of these levels again as interrupted by subdivisions, often of a very arbitrary but useful character. For instance, a line drawn forward from the lower end of the intraparietal sulcus and parallel to the fissure of Sylvius, will be found to mark very distinctly the division between the representation of movements of the upper limb and of the face behind the fissure of Rolando. A digression may be made here for the purpose of strengthening what has just been said, by pointing out, as may be easily done from the facts of comparative anatomy, that the fissure of Rolando as a sulcus which is transverse to the long axis of the hemisphere, is an intruder, disturbing the harmony of the longitudinal folding of the cortex into gyri, which is so characteristic of the convoluted cortex of the lower animals, and is probably of primal ontogenetic importance. We shall see presently, moreover, that this wide difference of the representation in the upper, as compared with that of the lower parts of the parietal lobe, is not confined to merely the parts of the body that are moved, but that it also determines the nature of the movement itself.

There remains yet another consideration of great general importance and which by reason of its applicability to every variety and degree of so-called motor function must now be discussed and for practical purposes settled in these prefatory remarks. We refer to the closely debated question of the intimate nature of the representation of movement that is to be obtained from any one given portion of the cerebral cortex.

To illustrate: If the electrodes of an induction coil be applied to the so-called motor cortex of a monkey, just above the lower end of the intraparietal sulcus, there will result the simple movement of flexion with adduction of the thumb—that is, practically speaking, movement in only one or at the most two segments of the limb; whereas, if the current be applied above the hinder end of the superior frontal sulcus, there will occur synchronous movement of all the segments of the lower limb and of one or two of the upper limb, the current in both this and the preceding instance being only of just sufficient strength to evoke movement. In these two cases it is obvious that the "nature" of the movements evoked by exactly the same means is completely different; the difference consisting both in the extent of the body moved as well as in the kind of movement produced. If now this simple effect of what may with justice be termed a minimal stimulation (Beevor and myself) be further complicated by increase in the force of excitation or in the proneness of neighboring centres to become involved in the act of discharge, we find movement is generated thereby in those parts of the body which lie next in serial order to the parts which were moved by the minimal stimulation. The movement produced by minimal stimulation has been termed, by Dr. Beevor and myself, the primary movement represented in that part,[1] and the subsequent additional movements as secondary. The existence of the experimental fact of the primary movement and the close correlation of neighboring parts is unquestionable, but it naturally affords material for divergence of opinion in its interpretation, and seems to the writer to suggest the following view of the manner in which movements are represented in the "motor" cortex.

Thus we are justified in believing that in any given part of the cortex, as minute as can be examined experimentally, there is represented a definite movement or combination of movements of a definite segment or segments of one or both of the opposite limbs; such movements or combination of movements being the primary movement as defined by Dr. Beevor and myself, and being elicited, be it remembered, by minimal stimulation only. Further, that secondary movements are due to the subsequent invasion by the discharge of nerve energy of those portions of the cortex which lie nearest to and are in close relation to the parts stimulated.

Such a view, of course, connotes that of the existence of a close commissural connection of one centre with another, and more than that, of the overlapping of the borders of such centres, or, in other words, the commingling of neighboring representations of movement.

The old opposition against the grand truths of cerebral localization, rested upon the gratuitous assumption that a demonstration of the representation of single movements of single muscles was necessary to the establishment of the accuracy of the theory. And this species of criticism continued to exist even after the crushing demonstration by Dr. Hughlings Jackson, that representation of function in this portion (his "middle level") of the central nervous system meant representation of movements, and not of muscles, and, indeed, it may still exist in the minds of some of those who forget that it is impossible for us to contract purposively one single muscle in the body.

To sum up the foregoing: in seeking for the most profitable utilization of the facts, plentifully derived from experiment and scantily from

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[1] For the introduction of these terms Dr. Beevor and myself are responsible, and details of the work upon which they were based will be found in the Proc. of the Roy. Soc., 1886, and Phil. Trans., 1887.

clinical observation, for determining the situation of localities of definite function (motor only, be it remembered), it is clear that we must first picture to ourselves very distinctly the extent of cortex in which definite segments of the body are represented, and then to define similarly the areas in which the various given movements are represented.

This must now be done with the help of diagrams, it being distinctly understood that the lines limiting the areas of representation either of segments or of movements are purely provisional, though founded upon the experiments of Dr. Ferrier, Professor Schäfer and myself, Dr. Beevor and myself, and also on my cases of operation on man. To be strictly accurate, judgment respecting such limitation of "centres" must obviously be restricted until our knowledge of the degree of representation in man is fully ascertained.

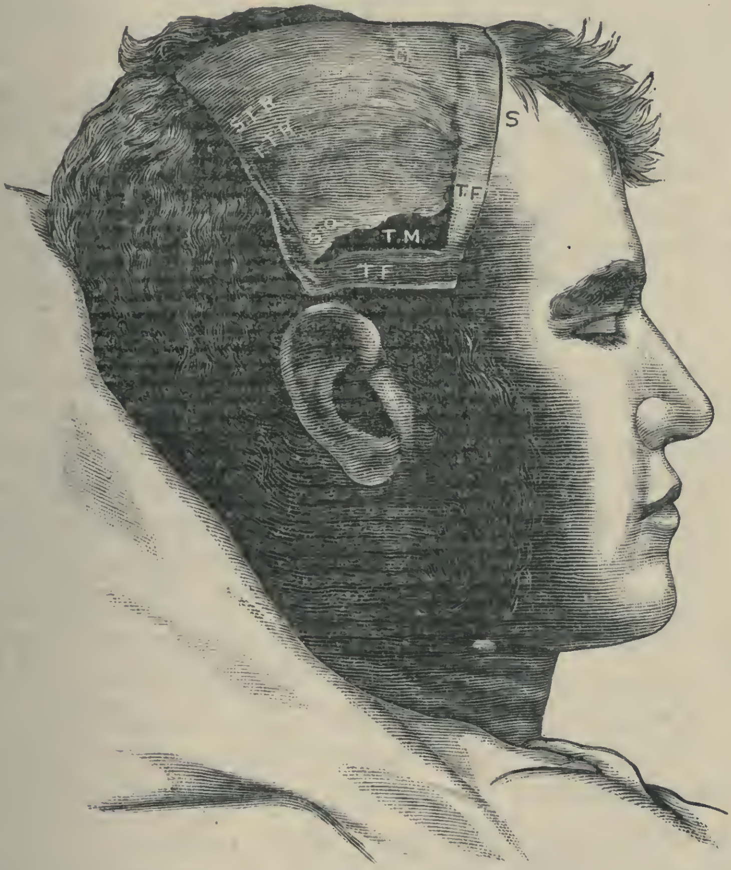
I. The Topographical Relations of the so-called Motor Region to the Exterior of the Skull.

In accordance with the object of this paper, it will now be best to describe the surface markings of the portion of the head inclosing the parts of the brain under discussion. There can be little doubt that the risk of topographical error increases in measuring from below upward;—*i. e.*, in mapping out the convexity of the calvaria by lines drawn upward from a line carried along the side of the base of the skull. It behooves us, therefore, to seek for means of measuring the position of the vertex parts of the brain from fixed points in the middle line.

The sutures (*vide* Fig. 2) occupy, of course, the foremost position among the *points d'appui* of topography. They need no description here, neither is any detail required of the other landmarks on the vertex beyond a few passing notes. Next to the sutures in importance come the eminences, and the so-called motor region is limited, roughly speaking, in front by the frontal eminence and posteriorly by the parietal eminence. As regards these eminences, it is easy to determine by taking antero-posterior and supero-inferior views of the skull from a short distance, the centre point of the elevation in each case, and this spot is known for topographical purposes as the eminence itself, though the descriptive anatomist would also include the sloping sides of the elevation. This wider view, of course, is useless for our present purpose, since it in no wise defines the limits of the eminences.

Next to the eminences, of course, will come in value the temporal ridges. These consist, and this can be verified on almost any skull, of two well-marked lines, the lower of which has alone been noticed till recently. This lower one is the more strongly marked, it is continued upward from the external angular process of the frontal bone, limiting anteriorly and superiorly the deep hollow of the front half of the temple fossa and following a semi-circular course along the lower part of the parietal bone till it is lost just above the attachment of the pinna. The point where it crosses the coronal suture was more conveniently and appropriately termed by Broca the stephanion. This temporal ridge marks the upper border of the attachment of the temporal muscle. Above it runs a second ridge or line also commencing anteriorly at the angular process of the frontal bone, but soon leaving the lower temporal ridge, until opposite the middle of the lower border of the parietal bone it is, as a rule, fully one centimetre above that of the temporal muscle. The uppermost ridge marks the attachment of the temporal fascia, and, it may be added, the periosteum covering the bone of the vertex and

Fig. 2.



This figure, from a photograph, shows the head of a cadaver from which the scalp has been removed opposite the so-called motor region of the brain. For this photograph and that of Fig. 3, I am very greatly indebted to my friend Dr. Wilson, Senior Resident Physician to the National Hospital for the Paralyzed and Epileptic, who prepared them from my directions under circumstances of inconvenience and special difficulty.

S.	Edge of cut scalp.
P.	Pericranium.
C.	Coronal suture.
S. T. R.	Ridge of temporal fascia, or superior temporal ridge.
I. T. R.	Ridge of temporal muscle, or inferior temporal ridge.
S. Q.	Squamous-parietal suture.
T. M.	Temporal muscle.
T. F.	Temporal fascia.

lower down beneath the muscle is more firmly attached to the temporal ridges than elsewhere. These two ridges might be advantageously known as the ridge of the temporal muscle and fascia respectively (*vide* Fig. 2). All these points can be made out on the living subject and with greater ease, of course, if the head be shaved. The only difficulties met with are in the determination of the coronal suture and the temporal ridges.

The coronal suture can be readily made out in most cases by steadily pressing the scalp with the thumb backward and forward over its supposed site. With a little practice the dentations can be detected, especially just above the stephanion. The bregma being easily defined by measurement or otherwise, the upper third of the coronal suture, which is usually very difficult to feel, can be filled in by continuing upward the line of the lower part discovered by palpation. We shall see, presently, that the determination of the coronal suture is of extreme importance.

The ridge of the temporal muscle can be most readily determined by telling the patient to shut the mouth very firmly: the temporal muscle will then stand out in relief and the outline of its upper margin becomes very marked. In the majority of instances the ridge of the temporal fascia can be felt by palpation. If not, it can be detected as being the first point at which the sloping bones of the roof of the skull become vertical to form the side walls.

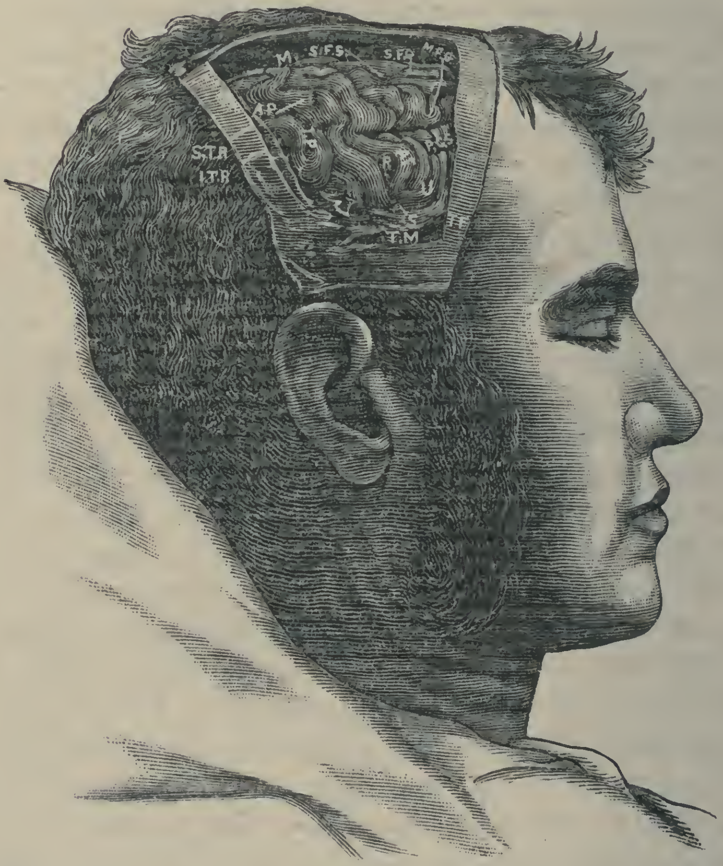
In some instances the coronal suture cannot be detected by palpation, but in its neighborhood there can be felt a rounded ridge which is bounded posteriorly by a distinct though shallow groove occupying the anterior sixth of the parietal bone, while a similar but less marked groove exists on the frontal bone in front of the ridge bearing the suture. The finger thus starting from the parietal eminence would, if carried forward, first gradually pass down into the above-mentioned groove, then would leave that crossing the ridge containing the suture and lose itself in the shallow groove on the frontal bone in front of the suture.

There is one line of suture of which no mention has yet been made, which is at the same time perhaps more important than the other, viz., the parieto-squamal (*cf.* Figs. 2 and 3). This semicircular suture is, of course, buried beneath the muscle in the temporal fossa, and attains its greatest height in a vertical line drawn in front of the articulation of the lower jaw, being at this point at about the junction of the upper and middle thirds of the distance between the ridge of the temporal muscle and the upper border of the zygoma. The H-shaped junction of the parietal, great wing of the sphenoid, the frontal, and squamous bones, marking as it does the divergence of the branches of the Sylvian fissure, was termed the pterion by Broca, and forms the commencement of the squamous suture.

The external relations of the pterion are, of course, also obscured by its being covered by the temporal muscle, but the sloping transverse (*i. e.*, antero-posteriorly directed) bar of the H indicating the sutural union between the anterior inferior angle of the parietal and the upper and posterior border of the great wing of the sphenoid is situated, generally speaking (*i. e.*, for English adults) half way between the stephanion and the upper border of the zygoma, the measurement being taken along a line drawn vertically to the zygoma from the stephanion.

THE RELATION OF THE CONVOLUTIONS OF THE "MOTOR" AREA TO THE PROMINENCES ON THE SKULL JUST DESCRIBED.—The first fissure of these regions to be determined in position is that of Rolando (*vide* Fig. 3). Hitherto this has been sought for by erecting verticals from a horizontal base line drawn through the external auditory meatus; but these lines, even with the aid of the instrument of Lucas-Championnière and others, are liable to error, from which it is believed the method now to be described is comparatively free. The better plan is first to adopt the method devised by Professor Thane, of University College, London, for locating the upper end of the fissure of Rolando. His plan is to take the length of the middle line of the head from the root of the nose—*i. e.*, the glabella—to the occipital protuberance or inion and then by halving the result to obtain the centre of the middle line of the head. The upper end of the fissure of Rolando will be found in adults to be situated half an inch behind this centre-point of the head. The only possible objection to this rule can be that the definite expression is introduced in terms of inches. But from numerous observations by Professor Thane and the writer this slight drawback has been found to have no practical importance whatever. In very many cases the spot indicated by this plan will be found to be exactly the upper end of the fissure. Given the commencement of a fissure at its highest point so correctly, it is obvious that if its direction is at all constant its exact position must be easily discoverable and determined. This is the case. Dr. Hare, of Edinburgh, has shown that the angle which the fissure makes with the middle line is very fairly constant. The extremes determined by him did not vary more than a few degrees and the mean of his measurements was sixty-seven degrees. To facilitate the clinical combination of the foregoing facts, I have caused to be constructed a very simple instrument of soft iron (nickelized) consisting of a long (10 inch) strip one centimetre broad, from the middle of which branches off another strip (about 6 inches long), the two making an angle anteriorly of sixty-seven degrees. On the short arm is marked on both sides a scale of inches commencing half an inch from the middle line. This instrument is used thus: The long arm is laid upon the middle line of the head which has been previously marked; the angle between the arms is then made to coincide with the theoretical situation (Thane) of the upper end of the fissure of Rolando; a line drawn down the anterior border of the short arm will now give the situation of the fissure perfectly accurately for the upper two-thirds of its course. The fissure of Rolando, however, is not a perfectly straight line. Both in the monkey (as observed by Beevor, myself, and Hare) and in man, the fissure runs downward and forward, but when about opposite the lower end of the intraparietal sulcus it becomes directed more vertically as it approaches the Sylvian fissure. It thus forms a slight knee at this part of its course. Both in the higher and lower animals the amount of the flexure of the fissure varies slightly but distinctly in different individuals. For this reason, although the lower end of the fissure does not vary more than a quarter

FIG. 3.



View of the same head as Fig. 2. The base being removed by a vertical saw-cut through the stephanion (inferior), by another along the squamo-parietal suture, by one parallel to the fissure of Rolando and just in front of the parietal eminence, and by one along the outer border of the sagittal suture.

M. Margin of the hemisphere.
S. F. S. Superior frontal sulcus.
S. F. G. Superior frontal gyrus.
M. F. G. Middle frontal gyrus.
P. C. S. Precentral or vertical sulcus.
A. F. Ascending frontal gyrus.
A. P. Ascending parietal gyrus.
I. P. Intraparietal sulcus.
R. Fissure of Rolando.
S. Fissure of Sylvius.
T. M. Temporal muscle.
T. F. Temporal fascia.
S. T. R. Superior temporal ridge.
I. T. R. Inferior temporal ridge.
U. Subordinate sulcus in ascending frontal gyrus which unites the phonatory centre.

of an inch in a horizontal plane, no line, more or less vertical, can determine it accurately. Nor is one necessary, as we shall see directly.

The next fissure to be considered is the fissure of Sylvius, consisting as it does of a short anterior and long posterior branch, and forming the inferior and to a slight extent the anterior limit of the "motor" region.

It has already been seen that the Sylvian fissure commences at the pterion, the anterior branch running upward and forward continuing, as it were, the line of the sphenoido-squamous suture but commencing one or two millimetres in front of it. The posterior branch passes upward and backward just above (on the average, one-half of a millimetre) the squamo-parietal suture as far as its highest point, and there leaving it continues by curving slightly upward toward the centre of the parietal eminence, which it nearly reaches.

By reason of the fact that this extremely important fissure gives off no branches save of a very subordinate character, and since it is so easy to localize its position, little more need be said here than to emphasize the fact that the anterior branch just in front of the lower end of the coronal suture limits the so-called motor region anteriorly, while the posterior branch, just below which lies the squamo-parietal suture, bounds the region inferiorly.

The pre-central or vertical sulcus, is the next important cortical landmark to be studied. This sulcus (not a fissure, there being only five fissures in the brain, viz., the longitudinal fissure, the Sylvian, the Rolandic, the parieto-occipital, and the great transverse fissure of Bichat), unlike the fissure of Rolando, runs parallel to and just behind the coronal suture. It is of extreme importance, as we shall see, since it divides two convolutions of very different functions, and because it has on either side of it convolutions in which most extensive representation of movement exists. Following the coronal suture, it then runs upward and slightly backward, so that when a tangent to the bregma is in a horizontal plane it does occupy a very vertical position, hence its second but inferior name of "vertical" (*vide* ascending frontal convolution infra). This pre-central sulcus, as a rule, reaches to about the centre of the fissure of Rolando, and from it diverges forward the inferior frontal sulcus about opposite the superior temporal ridge. The point named by Broca, the stephanion, should also be applied to the point where the superior temporal ridge crosses the coronal suture, and then we may speak of the superior and inferior stephanion. In some skulls these two are practically almost identical, owing to variations in the attachment of the temporal fascia and muscle respectively. Above the point of origin of the inferior frontal sulcus, the pre-central sulcus continues half way across the root of the middle frontal convolution. The localization of the upper part of the pre-central sulcus is, therefore, an easy matter, and further, the convolution passing around its lower end, and separating it from the Sylvian fissure, is very frequently of the same breadth, viz., about one centimetre, which may *practically* be regarded as constant.

It will be best now to consider the topographical value of the superior frontal sulcus. This usually fairly constant sulcus commences in the ascending frontal convolution about midway between the fissure of Rolando and a line continued upward in the line of the pre-central sulcus. Its commencement, a short upward sloping furrow, is thus well behind the latter sulcus, and is readily determinable on the skull after the positions of the fissure of Rolando and coronal suture have been defined. Both superior and inferior frontal sulci run forward and slightly downward, being for the most part parallel to the longitudinal fissure, and much complicated by the presence of many secondary branches. The rest of the frontal division of the so-called "motor" region, we shall return to in speaking of the convolutions, but it cannot be too clearly understood that this is the most important part of the excitable area of the cortex.

Behind the fissure of Rolando lies the intraparietal sulcus. This sulcus is noteworthy as forming a well-defined posterior limit to the "motor" region. It can be discovered externally by first localizing the position of the fissures of Rolando and Sylvius, and although it gives off no branches beyond very subordinate ones, it passes from the parietal lobe into the occipital, aud thus limits most accurately the posterior border of the "motor region." Its commencement at its lower end has been before referred to as being opposite the knee-like bend in the fissure of Rolando. As it passes upward it very soon tends to leave the fissure of Rolando, and thus forms the ascending parietal convolution, the summit of which is so widened as to receive the name of a lobule, namely, the superior parietal lobule. To this we shall presently return, as its topographical determination externally is extremely important. The intraparietal sulcus turns directly backward, below the horizontal level of the superior frontal sulcus, and it gradually comes to run more or less parallel to the longitudinal fissure, passing round the outer end of the external parieto-occipital fissure (which, probably in man, forms the posterior limit of the vertex border of the "motor" region), and terminates in the occipital lobe. In the first part of its course, while forming the posterior border of the ascending parietal convolution, the sulcus lies (externally) midway between the line of the fissure of Rolando and the centre of the parietal eminence. Further up, as it passes backward, it lies midway[1] between the longitudinal fissure and the centre of the parietal eminence. It is thus easily determined.

The parieto-occipital fissure may be briefly referred to in this connection, but this must be more by way of completeness of description than from absolute knowledge whether it really does form a landmark of representation of movement in the cortex of the human brain. It is a small fissure, rarely more than an inch in length in the adult; it is directed outward and slightly forward, thus nearly at right angles to the longitudinal fissure (into which it opens), and it lies almost invariably just in front of the apex of the lambdoid suture (usually two to three millimetres in front of that point).

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[1] The commonest line (*i. e.*, form) of the intraparietal sulcus has yet to be determined, and the real breadth of the ascending parietal gyrus consequently remains unknown also. The line of the intraparietal sulcus may, in many instances, pass closer to the parietal eminence than is stated above.

The first half of the description of the relations between the "motor" cortex and the skull being thus completed by the study of the sulci, it remains to consider briefly the convolutions formed by them. And since the size and proportions of the convolutions are absolutely dependent on the distribution and state of the sulci, little remains to be added to what has been said above, save in the way of general statements in especial reference to the various centres of representation which are contained in each, and in noting at the same time the presence of those secondary sulci which appear to have a power of restricting[1] the areas of representation.

The first convolution of greatest importance is the ascending frontal. Beginning with its base or foot, which we have just seen to be covered by the anterior inferior angle of the parietal bone, we must first point out that, unfortunately, there prevails some indefiniteness concerning the terminology of this important spot. Thus the gyrus which separates the lower extremity of the fissure of Rolando from the fissure of Sylvius, was named by Broca the operculum, but apart from the fact that Gratiolet had already appropriated this expression to denominate the posterior border of the external parieto-occipital fissure in monkeys, it was obviously highly undesirable thus to name specially a small portion of brain surface which could not be accurately delimited. Moreover, the introduction of the term was superfluous, since owing to the fortunately very distinctly vertical direction of all the principal sulci about this spot, there is no difficulty whatever in marking off the foot of the ascending frontal convolution by simply mentally prolonging the fissure of Rolando posteriorly and the pre-central sulcus anteriorly into the fissure of Sylvius.

And, of course, at the same time we are as distinctly defining the foot of the ascending parietal on the one hand and the hinder end of the inferior frontal convolution on the other.

To return now to the ascending frontal, we note that in man the foot of this convolution is sometimes narrow, unlike the homologous structure in monkeys, a very suggestive difference. Although it may be narrow, this foot constantly presents a partial division by a vertical subordinate sulcus (s. s. Fig. 1), and this is always present in the monkey, in which animal it has a very decided significance (*vide* page 357). Opposite the hinder end of the middle frontal convolution the gyrus attains its greatest breadth, and narrows again very markedly opposite the hinder end of the superior frontal sulcus, this narrowing also conditioning, or rather coinciding with a difference in representation of function. Above, the gyrus terminates in the marginal convolution.

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[1] In speaking thus of a sulcus restricting representation of (motor) function it must be here stated that excitation by faradism of the walls or bottom of a sulcus evokes no movement, and further that, as is well known, the large "motor" corpuscles of the fourth layer are not found in the walls deeper than the depth of the cortex, measuring perpendicularly to the surface of the hemisphere.

Unlike the two great central gyri, the frontal convolutions present numerous subordinate sulci. They decrease in vertical breadth from below upward. The inferior frontal gyrus is broader posteriorly where the movement of the head and eyes is represented, and without entering into a discussion as to what is causative of the greater breadth of the base of the frontal lobe as compared with its anterior extremity, we may note that the vertical width of the hinder end of the inferior frontal convolution is correlated with the upward direction of the anterior limb of the fissure of Sylvius, which may figuratively be regarded as pushing the gyrus upward. (*Vide* Figs. 1 and 2.)

The middle frontal convolution preserves its breadth fairly constantly, but we have nothing to do in the present paper with the consideration of the architectural arrangement of the forepart of the frontal lobe, since that, so far as we know, is not "motor," if efferent in function.

The hinder end of the superior frontal convolution is limited posteriorly by an imaginary line drawn from the hinder end of the superior frontal sulcus to the longitudinal fissure, and parallel to the fissure of Rolando. The external relations of these parts have been already dwelt upon, and it only remains, therefore, to state that this gyrus also, like the next, though narrower, is of fairly constant breadth, lying parallel to the longitudinal fissure.

It will be remembered that the superior longitudinal sinus lies just to the right of the middle line, so that its left border is almost coincident with the exact medial line of the head. It thus necessarily follows that the inner border of the right hemisphere will lie, as a rule, just outside of the line joining the ends of the widest denticulations of the sagittal suture: while, on the other hand, the margin of the left hemisphere will border closely on the middle line.

The ascending parietal convolution is neatly marked out by the intraparietal sulcus behind, and the fissure of Rolando in front. Soon after it has passed the genu of the latter fissure it widens to form the superior parietal lobule, as before mentioned, and by reason of its continuing posteriorly with the occipital lobe around the outer end of the parietal occipital fissure, it is not surprising to find that the part termed this lobule is divided by subordinate sulci. In the monkey there is a small and subordinate, but remarkably constant sulcus, on a level with the superior frontal, which marks off a small portion of the gyrus anteriorly. This sulcus is always present in man, and according to the degree that it is developed the parietal lobule varies in shape. The exact arrangement of the sulci here requires further attention.

It is, of course, at present impossible to divide the lower margin of the parietal lobule from the rest of the convolution, but it is to be hoped that localization will clear up this problem in man ere long.

MESIAL SURFACE.—The only part of the mesial surface which concerns us at this present time is the marginal convolution, or, more strictly speaking, its posterior half, the paracentral lobule being included in the same. The external topographical anatomy of this gyrus is, of course, simply that of the border of the hemisphere mentioned above.

II. THE ENUMERATION AND LIMITATION OF THE AREAS OF REPRESENTATION OF THE DIFFERENT PARTS OF THE BODY IN THE GYRI THUS TOPOGRAPHICALLY DETERMINED.

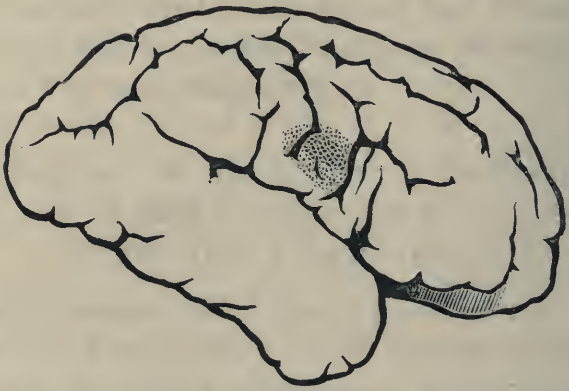
We are now in a position to set before ourselves the quality and extent of the representation of the various parts of the body in this so-called motor region, and so, knowing where each primary (see page 347) movement is represented, we shall be able, with the aid of the topographical facts just detailed, to picture to ourselves the seat of a lesion which has revealed itself by evoking or paralyzing that particular movement.

In discussing the manner in which we propose to regard the functional arrangement of the convolutions, reason was shown (page 345) for figuring to the mind a horizontal division of this region of the brain; and in treating of the exact localization of function in these parts we shall adopt these views as of great assistance.

We may well begin the consideration of the extent and nature of the movements represented in this region with those of the face and throat. If a line (referred to before) be drawn through the lower end of the intraparietal sulcus and through the genu of the fissure of Rolando, thus cutting off the bases of the ascending convolutions, it will indicate with perfect accuracy the region in which the facial movements blend with those of the upper limb. The representation of the movements of the face and throat extends from the line just mentioned superiorly to the Sylvian fissure inferiorly, and from the pre-central sulcus with its theoretical inferior continuation anteriorly, and the theoretical extension of the intraparietal sulcus to the Sylvian fissure posteriorly. The exact details of the representation of the movements of the face and throat have not yet been thoroughly investigated experimentally, nor (as might have been anticipated) has clinical observation filled up the blank.

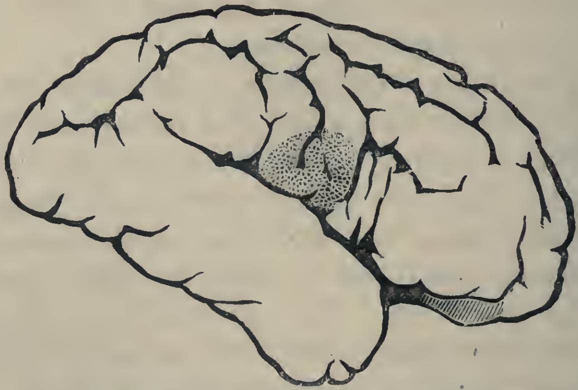
Several points have, however, been made fairly clear by the work of Dr. Ferrier, Professor Schäfer, and myself, and Dr. Semon and myself. Further, in one case of exploratory operation (Case V.) in this region the writer applied the faradic current (one litre bichromate cell, Du Bois Reymond induction coil, and platinum electrodes) to the surface of the cortex with the view of determining the limitation of the representation of the region of the face, the object of the operation being to excise this area. The electrodes were applied at a spot in the foot of the ascending frontal convolution, at that point which is the junction of the middle and upper thirds of the facial area, the effect of the stimulation being the production of movement of the jaw toward the left, and of the left angle of the mouth.[1] It is in the upper part (*vide* Fig. 4) of the facial area that the movements of the opposite angle of the mouth, etc., viz., all the groups of muscles being involved which make up what is clinically known as

FIG. 4.



Representation of the upper face and angle of the mouth.

FIG. 5.



Representation of the vocal cords (adduction).

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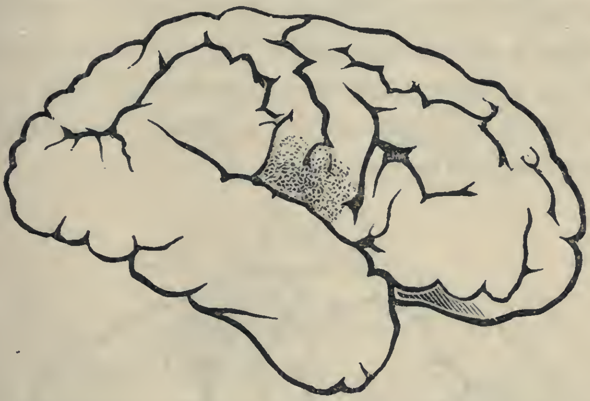
[1] This spot was clearly the seat of blending of the contiguous borders of the facial areas shown in Figs. 4 and 6.

the lower face, are represented. The remainder of the region for the movements of the face may be conveniently divided into thirds. The anterior third (*vide* Fig. 5), according to the investigations of Dr. Semon and myself, being the seat of representation of the movement of complete adduction of the vocal cords, together with associated movements of other parts of the throat. The hinder two-thirds (*vide* Fig. 6) of the lower portion of the facial region is the seat of the representation of opening and shutting movements of the mouth with protrusion and retraction of the tongue and the floor of the mouth (Ferrier, Schäfer, and myself). In accordance with what has been said before, it is to be clearly understood that the areas of representation of these movements are functionally concentrated in the parts of the facial region indicated, but that each blends with the areas surrounding it, there being no sharp line of demarcation between them.

Fig. 6.

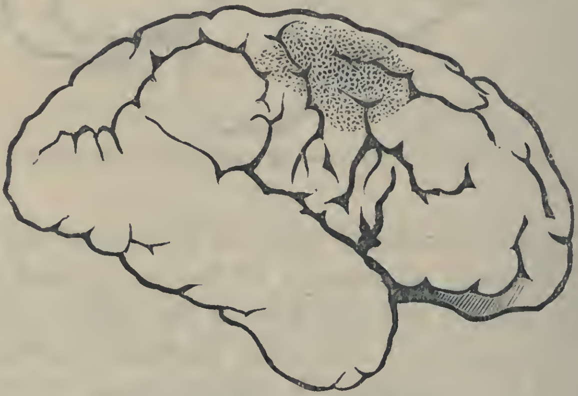


Representation of the lower face and floor of the mouth.

The next area in topographical order is that for the upper limb. The movements of the upper limb are so highly specialized in monkeys and in man as to occupy an extensive area of cortex in their representation, thus the movement in the upper limb—*i. e.*, of one segment of it or another can be elicited by irritating any part of either of the ascending convolutions from the line just mentioned as limiting the upper border of the facial region to a line continuing backward in the direction of the superior frontal sulcus. And yet the representation of the upper limb does not stop here, for it is continued over the superior frontal sulcus into the superior frontal convolution, though here, as we shall later see, every movement of it,—*i. e.*, the upper limb—is synchronously accompanied by contraction of the lower limb. Anteriorly, the upper limb region extends into the middle frontal gyrus for about its posterior fourth; the anterior half of this forward extension being also blended with the representation of the head and neck.

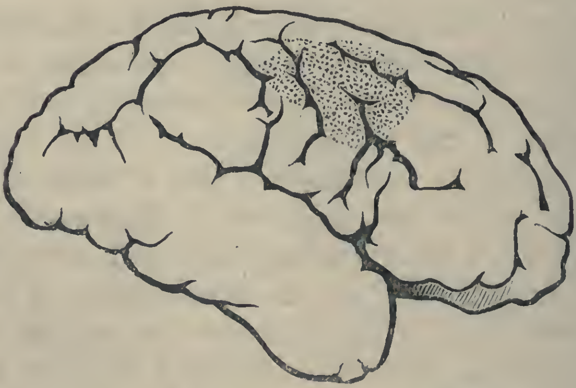
Now this very extensive and important area has recently been analyzed in minute detail by Dr. Beevor and the writer,[1] and what has just been stated is the embodiment of the results thus obtained. And in thus summarizing the details, it may be expedient to call to mind that the object of the present paper is simply to show clearly which parts of the limbs are most represented in which parts of the area; or, to use more popular language, to demonstrate which are the "centres" of the movements of those parts. The nature of the differences of the movement of such parts, though extremely important, is yet subordinate to the question of the *primary* representation of the parts moved when the practical needs of the diagnostician are considered. The first thing to be done, therefore, is to show the degree to which the various segments of the limb are represented in the area.

FIG. 7.



Representation of the shoulder.

FIG. 8.



Representation of the elbow and wrist.

Most briefly the distribution of the parts amounts to this: the shoulder is centred in the upper part of the area, the elbow next below and pos-

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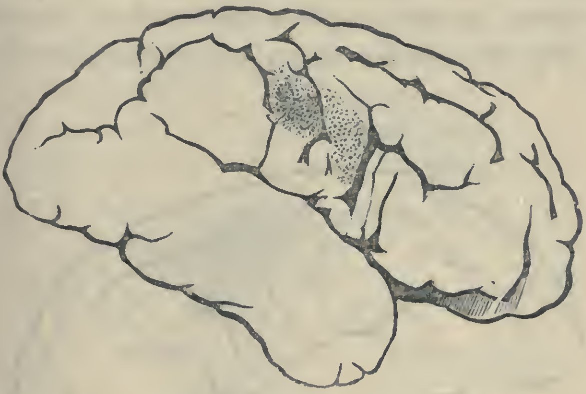
[1] Proc. Roy. Soc., 1886.

teriorly, the wrist next below and anteriorly, the fingers next below and anteriorly, the thumb lowest and posteriorly. In other words, the primary representation of (*vide* Figs. 7, 8, and 9) the various segments of the limb is parallel to their anatomical arrangement—viz., from above downward. But another fundamentally important consideration here intervenes and gives a very definite character to the representation of the upper limb. This is the fact recognized by Dr. Beevor and the writer, that the elbow and wrist are hardly ever the seat of primary movement alone. The wrist is, of course, frequently the seat of primary movement, as may be seen in the accompanying diagram, but the existence of its own primary movement is evidently conditioned by the necessities of the never absent associated movement of the digits. The elbow very rarely ever moved primarily in association with other parts.

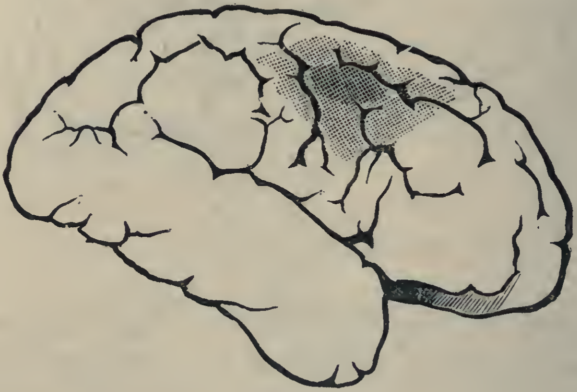
Fig. 9.



Representation of the thumb.

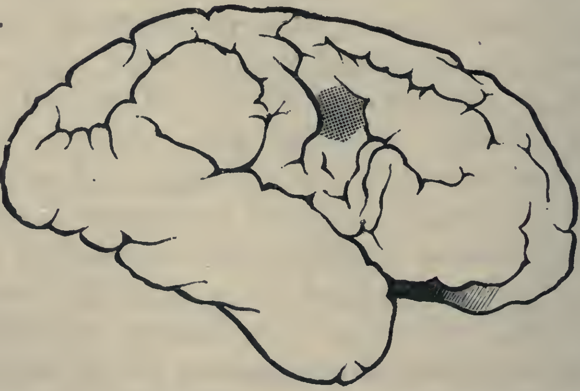
Viewing, on the other hand, the *movements* of the limb as a whole, we find that there is hardly one in which the elbow and wrist do not take part. Consequently, we conclude that these central joints are subordinate and that too, to the shoulder on the one hand and to the digits on the other. Finally, we have represented most briefly by (*vide* Figs. 7, 8, and 9) diagrams borrowed from the paper before referred to, the relative degree to which the various joints are represented in the upper limb area; the darkest shading signifying the most intense representation, or, as it would be popularly termed, the centre for the movement of that joint. It is advisable to point out here, that the transference of the results obtained by experimental investigation of the cortex of the monkey's brain, to translate the symptoms arising from irritative lesions in the human cortex, is very exact and reliable. Nor is this to be wondered at, since, as we are all of us aware, the movements of the upper limb in the monkey and in man are nearly identical. Confirmation of the truth of this statement is furnished by three cases of cerebral tumor from which I have successfully removed the growth, localizing the same by the aid of the rules given in this paper. The situation of the lesion in each case, together with the primary movement elicited by the irritative effect of the same, is given in the accompanying diagrams (*vide* Figs. 10, 11, and 12), the primary movement in these cases meaning, of course, the first tonic spasm in epileptic fits produced by the lesion. In one case (Case IV., Fig. 10) the fits began with flexion of the shoulder, the remaining segments of the limb being affected in order from above down, while finally the leg and face became affected. At the time of operation there were absolute hemiplegia and coma, both of which were relieved by removal of the tumor, which weighed four ounces and clearly grew in the corona radiata toward the cortex. Full details will shortly be published. In another (Case II., Fig. 11) the fits began in the thumb. The case is fully described in the *Brit. Med. Journal* for October 10, 1886. In the third a diffuse tumor (Case X., Fig. 12) invaded the shoulder region and caused constant clonic spasm of the shoulder- and elbow-joints, besides severe fits beginning in the shoulder. Full details

Fig. 10.



Case IV.

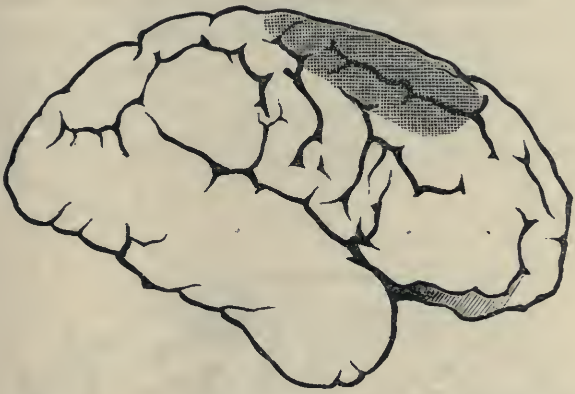
Fig. 11.



Case II.

will soon be published. The confirmation of the accuracy of the experimental diagnosis really rests, of course, upon the fact of the tumor, etc., being found at the time of operation exactly where it was before determined to be.

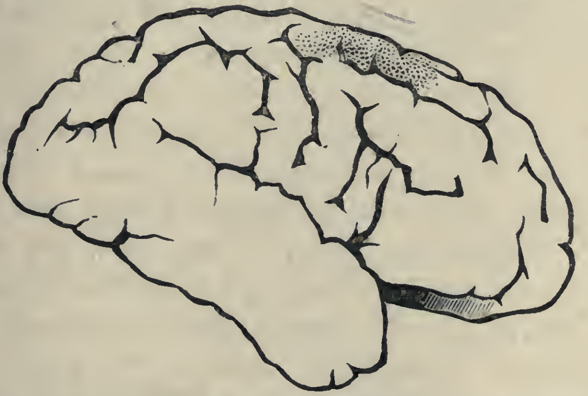
Fig. 12.



Case X.

Leaving now the areas for the upper limb, and crossing therefore the superior frontal sulcus, we come first into a region where the representation of the upper limb and that of the lower limb are absolutely blended. This condition exists most markedly in the hinder sixth of the superior frontal gyrus abutting on the upper end of the ascending frontal (*vide* Fig. 13). This latter portion of cortex, however, really forms an integral part of the lower limb area, especially the same extending back behind the upper end of the fissure of Rolando into the so-called parietal lobule, which is nothing more than the upper part of the ascending parietal gyrus. This area of combined action of the limbs is a very remarkable one. The movement of the upper limb, which, be it remembered, is absolutely synchronous with that of the lower, consists primarily and essentially in what is known to anatomists as flexion of the

Fig. 13.

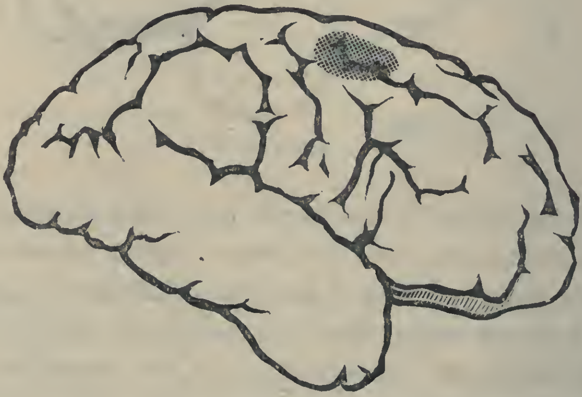


Reproduction of the combined synchronous action of both limbs.

shoulder, in which movement the humerus is brought forward in a plane parallel to that of the middle line of the body. Consequent upon this movement of the shoulder the elbow is also extended. The movement represented in this region, according to Dr. Ferrier, *Functions of the Brain*, 2d ed., p. 481, are "various complex movements of the arms and legs, such as are concerned in climbing, swimming," etc.

Dr. Beevor and myself are about to publish a minute analysis of all this region, the function of which is so interesting as well as important. The representation of this combined movement of the limbs is shown in Fig. 13. Further, a case of traumatic epilepsy (Case I.,[1] *vide* Fig. 14), in which I freely removed a thick, fleshy, congested scar which penetrated an inch into the substance of the hemisphere, exemplified this localization of function, since the primary movement in the epileptic fit commenced in the complicated manner just indicated, the lesion being situated at and around the hinder end of the superior frontal sulcus.

FIG. 14.



Case I.

In a similar case, though not so perfectly limited (Case X., *vide* Fig. 12), in which I removed a four ounce tumor from this same region, a similar primary combined movement of both limbs was observed; additional information for localization purposes, however, being supplied by the fact that more recent involvement of the shoulder area was producing constant clonic spasms of the upper segment of the upper limb.

We may now leave the topographical diagnosis of lesions along the line of the ascending frontal gyrus, except as regards its summit—*i. e.*, immediately in front of the upper end of the fissure of Rolando. Here, as has just been remarked, commences the representation of the lower limb only (*vide* Fig. 15), and the primary movement of this part is that of the hallux. This functional representation is continued over the margin of the hemisphere into the paracentral lobule (Schäfer and the writer), but the especial determination of the representation of the hallux will be fully described in a forthcoming paper by Dr. Beevor and the writer. Meanwhile, as the following case shows, advantage was taken of the knowledge gained by the incomplete investigation to diagnosticate the situation of a cortical lesion and, as it proved, successfully. I owe the opportunity of seeing and treating the case to the kindness of my friend Dr. Savill, medical superintendent of the Paddington Infirmary.

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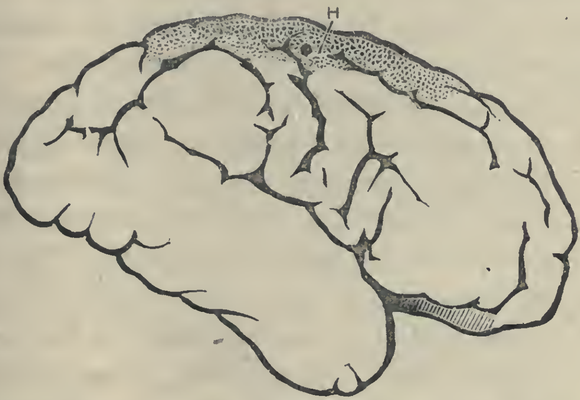
[1] Vide British Medical Journal, October 10, 1886, for details.

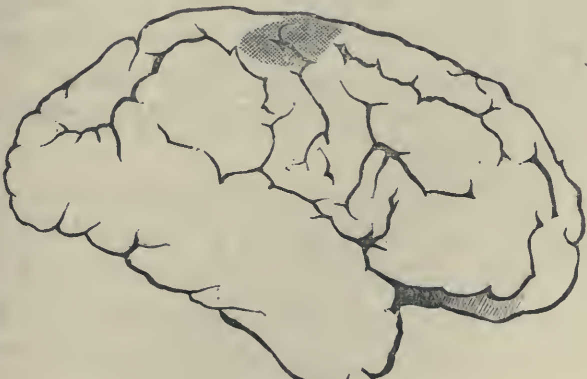
Fig. 15.



Representation of the lower limb. H. Focus of representation of the hallux (Beevor and writer.)

Case VII., a navvy, was struck on the head with a pair of tongs eight or nine years ago, while intoxicated, no obvious injury save a scalp wound being produced. Traumatic epilepsy resulted, the primary movement consisting in flexion of the hallux followed by the gradual flexion of the rest of the lower limb and that followed by successive invasion of the rest of the body in the usual order. The fits, however, returned with increasing violence and e came under the care of Dr. Savill two years later. When the writer saw the patient the fits were of the same character as heretofore. The skull having been uninjured by the accident, the diagnosis was made of a cicatricial lesion situated (*vide* Fig. 16)

Fig. 16.



Case VII.

about the upper end of the fissure of Rolando invading the upper end of the ascending frontal gyrus. On freely opening the skull and dura mater a dense and cystic cicatrix was found at this spot and almost completely removed (a small portion had to be left behind in consequence of the patient, an alcoholic subject, collapsing at this stage of the operation, rapid completion of which, however, effected his recovery). Since a week after the operation he has had no further fits. This case illustrates the truth of the representation of the hallux being situated at this point. In a further case twice referred to before (Case X., Fig. 12), recently (five weeks ago) operated upon by the writer, a tumor (also weighing four ounces, see Case IV.) was removed and with it the cortex in front of the upper end of the fissure of Rolando. The only permanent complete paralysis in the lower limb is that of the hallux. The representation of the lower limb only was described by Ferrier as situated in the upper part of the ascending parietal gyrus, the so-called parietal lobule. As just mentioned, the representation of the lower limb was also found by Schäfer and myself to be continued over into the mesial surface of the hemisphere. This very important region and function being the subject of further investigation still incomplete, must now be left in order to complete the discussion of the function of the posterior border of the so-called motor region by glancing, in way of review, at the function of the ascending parietal gyrus, while as has just been stated, the upper portion of the gyrus forms part of the area for the lower limb only. It was found by Dr. Beevor and myself (*Proc. Roy. Soc.*, 1886) that the shoulder (adduction with retraction) was next slightly represented in the superior parietal lobule, viz., in the horizontal line of the superior frontal sulcus continued backward. Further, that the rest of the gyrus as far as the lower end of the intraparietal sulcus was the seat of representation (partly combined) of the elbow and wrist in the upper third—*i. e.*, of the arm area and of the thumb and index in the remainder, together partly with the wrist and elbow except at the lowest point, see Figs. 8 and 9, which was reserved for the movements of the thumb.

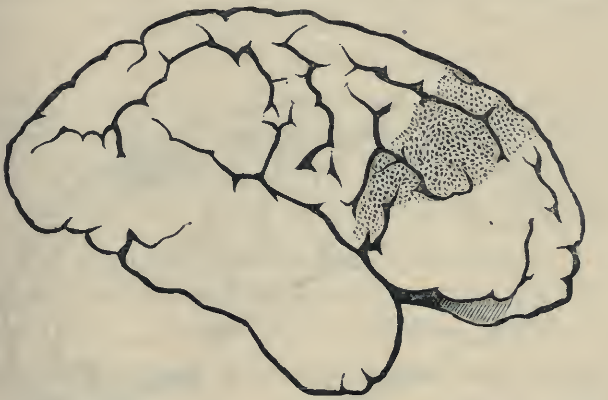
We are now left with the consideration only of the representation of the head and neck and eyes.

As indicated by Ferrier, the area of representation of these parts occupied almost solely the middle frontal gyrus, and this, no doubt, is the focus of representation of the movement of the turning of the head and eyes to the opposite side, but a minute analysis (by Dr. Beevor and myself) to be published shortly, will show that a much more extensive representation as indicated in Fig. 17 exists.

It must be left, for the present, an open question as to how far the representation of this important and interesting conjugate movement extends *forward* in the frontal lobe. A definite answer can only be given when the homologies between the sulci and the frontal lobe in the

Macaque monkey and man have been thoroughly determined. That this area of function is continued over the margin of the hemisphere into the marginal convolution, has already been shown by Professor Schäfer and myself. (*Proc. Roy. Soc.*, 1885.)

FIG. 17.



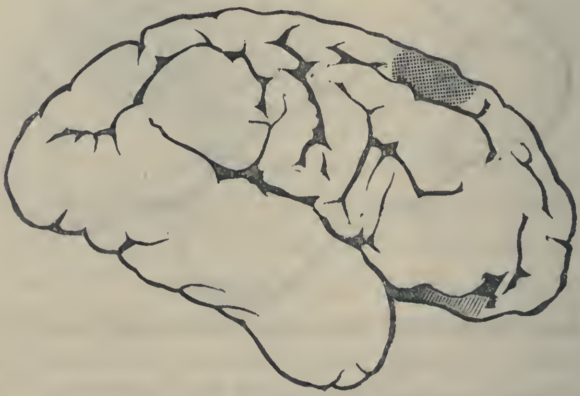
Representation of the head and neck together with conjugate deviation of the eyes

In every instance the head and neck are turned to the opposite side, and in some parts there is produced at the same time or later, conjugate deviation of the eyes.

So far, scarcely any mention has been made of the topography of representation of the other trunk muscles, neither has notice been taken of the movements of the organ of special sense, observed by Dr. Ferrier on exciting those portions of the cortex which he deemed to be the perceptive centres of those special senses. It will be remembered that the scope of this paper does not admit of a discussion of these latter observations.

As regards the trunk muscles, much might be said, but reference for detail is invited to the above mentioned paper in the *Proc. Roy. Soc.*, 1885. It is, however, worth while pointing out, psychologically speaking, that there is scarcely ever performed a highly purposive act by the trunk muscles only. The movements of the trunk are simply subordinate to the purposive movements of the limbs, and consequently we should not be surprised to find, as is the case, how extremely small a portion of the cortex is sufficient for primary representation of this part of the body. An illustrative case of the position in the human brain of the areas we have just been considering, is that of Case III., in which a man had been the victim of traumatic epilepsy for many years due to a small punctured fracture of the vertex of the skull, the said fracture being demonstrated externally by a minute depression three or four millimetres broad. The puncture had caused splintering of the inner table, laceration of the dura mater, and partial destruction of the subjacent cortex, so that at time of operation (eleven years later) there was found a rough ring of bone on the inner surface of the skull around the centre of the fracture, from which a sharp and corrugated fragment one cm. long by five mm. broad projected downward together with a flap of entangled and torn dura mater into the wall of a small cystic cavity in the cortex just above the junction of the middle and posterior thirds of the superior frontal sulcus. This fairly extensive lesion (*vide* Fig. 18), which was freely removed (the result being cure of the epilepsy), was thus situated at the point of meeting of the area for the muscles of the trunk, of the area for raising with protrusion of the upper limb, and of that for turning the head and eyes to the opposite side of the body. The existence of such a lesion was diagnosticated from the fact that the course of events in the epileptic fit began with an aura of contraction of the abdominal muscles, this was followed by turning of the head and eyes to the opposite side, and then there occurred the raising of the upper limb. The exemplification of the topographical relations of these centres was thus faithfully demonstrated.

Fig. 18.



Case III.

Conclusion.

As expressed at the outset, the object of this note was simply to discuss the methods employed by the writer in topographical diagnosis of disease of the so-called "motor" region only of the cortex cerebri, and, consequently, nothing more than a mere *résumé* of the facts which have been found useful to bear in mind has here been attempted.

Indeed, a very considerable branch of the subject of cerebral localization has only been glanced at, namely, the localization of the representation of the various movements of the joints—the representation of flexion and extension respectively, etc. The commencement of the consideration of this division of the subject is contained in the papers by Dr. Beevor and myself, and to these reference must be made, as, owing to the novelty of the facts, only cautious use of them for diagnostic purposes is possible, and for this reason no further examination of this point has been made in this paper.

Perhaps the peculiarly wide interest attaching to the subject itself will be considered an adequate cloak for the bareness with which the said facts have been presented.

THE DIRECT ACTION OF ATROPINE, HOMATROPINE, HYOSCINE, HYOSCYAMINE, AND DATURINE ON THE HEART OF THE DOG, TERRAPIN, AND FROG.

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U. S. NATIONAL MUSEUM.

The alkaloid "atropia" was discovered about fifty years ago by Mein, Hesse, and Geiger. Since that time a host of experimenters have been engaged in the investigation of the action of this drug.

So difficult and perplexing, however, has been the study of its physiological properties, that more than half a century has elapsed without bringing the question to a final or generally satisfactory issue, notwithstanding the fact that many of the most prominent physiologists of the present day have been more or less engaged in grappling with the problem.

A perusal of the unusually rich literature of the subject, with its numerous controversies, bears, indeed, ample testimony of the great difficulty which the interpretation of even the most simple physiological phenomena may, at times, present, and points out the many dangers of forming erroneous conclusions from apparently the most precise and accurately performed operations. So far as the action of atropia on the heart is concerned, the best authorities still differ in about the following points: (1) That its action may be fully explained by assuming that a paralyzing influence is exerted on the terminal filaments of the pneumogastrics; (2) that atropia at first stimulates and then paralyzes these filaments; and (3) that it not only paralyzes the terminal filaments of the pneumogastrics, but also stimulates the vasomotor apparatus of the heart.

From some of my former experiments with atropia on the heart and bloodvessels of cold-blooded animals, I was led to conclusions which differ materially from those which are generally accepted by the majority of authors.

The results thus obtained seemed to point clearly to the fact that both the inhibitory and vasomotor apparatus of the heart became excited under the influence of atropia. The reduced ventricular rate following the increased rate was thought to be the result not only of the beginning of exhaustion of the musculo-motor apparatus from over-stimulation, but also of a still existing excitation of the inhibitory apparatus of the heart. This stage of atropine poisoning, however, is shortly followed by diastolic arrest, especially in warm-blooded animals, and to suppose that the inhibitory nerve-apparatus of the heart is still in a state of excitation immediately before diastolic arrest is produced as a consequence of musculo-motor exhaustion due to previous over-stimulation by atropia, would be equal to assuming that the inhibitory nerve-apparatus had never been paralyzed at any time before the death of the whole heart, but, on the contrary, continued in an excited state until the last; in other words, the normal influence of the inhibitory nerve-apparatus over the heart's action is merely inhibited by the over-excited condition of the musculo-motor apparatus and continues inhibited until the latter shows signs of exhaustion.

This view of the subject being clearly opposed to most of the at present received opinions, and the best authorities still differing greatly among themselves, it was our purpose to extend and enlarge the then limited material from which these conclusions had been drawn, and investigate the action of the entire atropine group on the heart of both cold- and warm-blooded animals. It is hoped that the results of these investigations may prove to be a useful addition to our knowledge of the physiological properties of atropine and its allies, not only on the heart but also with regard to its general action.

The method which was employed in experimenting on the frog and terrapin having already been given in detail in some of the previous papers published in this journal, I need here only mention the various steps for the successful isolation of the mammalian heart according to Martin's method, at the same time referring those more especially interested to the more detailed account published by Prof. Martin himself in the *Transactions of the Royal Society*, Part ii., 1883.

Isolation of the Heart of the Dog.—The animal having been placed under the influence of morphia, is fastened to a dog-holder, tracheotomy is performed and a canula introduced into the trachea. The external jugular vein is then dissected out and a canula filled with normal salt solution introduced with its open end pointing toward the heart. Through the latter canula about half a drachm of a one per cent. solution of curare is injected, after which injection artificial respiration is commenced. The vagi are now found and carefully divided. Canulas are introduced into the cardiac end of both common carotids, the arteries being clamped on the cardiac sides of the canulæ. The first two pairs of costal cartilages are now cut away together with the small piece of sternum which they embrace. Then the two internal mammary arteries are ligated just as they pass forward from the subclavians toward the breast-bone. The whole front and sides of the thorax are now cut away and the right subclavian artery dissected out and tied just above the point where it separated from the common carotid. The superior vena cava is next prepared and a ligature placed loosely around the vessel for subsequently occluding it and tying a canula into its cardiac end.

Proceeding now to the left side of the chest, the subclavian artery of that side is ligated, and, the left lung being gently held aside, the arch of the aorta is isolated and cleared just beyond the origin of the left subclavian; a strong ligature is placed loosely around the vessel ready to be tightened. The azygos vein is next tied, and a ligature placed loosely around the inferior vena cava just as it appears above the diaphragm. Finally, a canula, previously filled with warm blood, is tied into the cardiac end of the superior vena cava, and the animal is prepared to be transferred into the warm, moist chamber in which it is to remain during the experiment.

The canula in the superior vena cava is at once connected with the common outflow-tube of several Mariotte's flasks, which contain the blood of proper temperature intended to feed the heart. The clamps are removed from the carotids, their canulas connected with the outflow-tube, which communicates with a mercury manometer writing on a continuous paper roll. The ligatures, which were but loosely placed around the aorta and inferior vena cava, are now tightened; the heart is washed out for a few moments with the blood from the Mariotte's flask until it is free from clots, and at last the outflow-tube is adjusted so as to secure the proper pressure for the normal working of the organ. The temperature of the circulating fluid may be read off at any time from the thermometer placed into the common outflow-tube.

The remainder of the apparatus consists in a warm, moist chamber, which must be large enough to accommodate the animal on the holder as well as the feeding flasks. The supplying flasks stand on a platform which can be raised or lowered according to the requirements of the particular case. The height of the bottom of the outflow-tube above the heart of the animal is referred to in the experiments as the venous pressure. This pressure, after once being adjusted, generally remains uniform throughout an experiment, and is the same for all the flasks. The outflow-tube, which is connected with the two common carotids, and from the end of which the blood pumped around flows out, and may be measured at stated intervals, is raised to a height which is deemed sufficient to maintain a normal pressure in the coronary arteries. Everything being in readiness, observations are begun a few minutes after the heart has performed normal work.

The drugs which were employed in these investigations came from the firm of Parke, Davis & Co., of Detroit, Mich. Hyoscyamine, hyoscine hydrobromate, and daturine were manufactured by the firm; the sulphate of atropine and homatropine hydrobromate had been obtained from Merck's establishment.

ATROPINE GROUP.—Chemically speaking, the remedies belonging to the atropine group, so-called, as atropine, daturine, hyoscyamine, and hyoscine, are probably all identical. Of late their chemical composition has been investigated more especially by Ladenburg, whose researches, however, according to Harnack,[1] have not as yet led to entirely satisfactory results. They all possess the common formula, $C_{17}H_{25}NO_3$, and have been found to consist of a basic tropine or pseudo-tropine, $C_8H_{15}NO$, and tropic acid, $C_9H_{10}O_3$, which has been artificially produced by Ladenburg and Rugheimer.

By boiling these alkaloids with acids or alkalies, they are decomposed into tropine and tropic acid. By the substitution of tropic with other acids, Ladenburg has succeeded in producing certain semi-artificial substances, which he has termed "tropëines."

Atropine is found in atropa belladonna, datura stramonium, hyoscyamus niger, and duboisia myoporoides. Daturine is mentioned as being a mixture of atropine and hyoscyamine. Hyoscyamine is derived from the same plants as atropine, and, like it, may be split up into tropine and tropic acid, but these products were formerly known as hyoscine and hyoscinic acid. Hyoscine is obtained from hyoscyamus niger, but may also be derived from hyoscyamine; it is much more difficult of crystallization, is isomeric with hyoscyamine, and decomposable into pseudotropine and tropic acid.

For hyoscine, Harnack has proposed the name of "Sikeranine," on account of the term hyoscine having formerly been applied to one of the products of decomposition of hyoscyamine. Homatropine is one of the semi-artificial tropëins obtained by the action of amygdalic acid on tropeïne, thus producing *oxytoluglytropeïn.*

So far as their action is concerned, that of atropine and hyoscyamine is supposed to be identical, the two drugs differing only in their effects upon the central nervous system. Hyoscine is said to act, in some respects, stronger, and homatropine, in all respects, weaker than atropine. Tropine is said to have no effect on the pupil, and in the experiments made with some of the semi-artificial atropines (tropëines), where tropic acid has been replaced by other acids, the effect upon the pupil was found to be either wholly negative or very much modified. These observations are of considerable importance, for if, as Gaskell maintains, the dilatation of the pupil is an active phenomenon, due to stimulation of inhibitory nerve-structures, a close connection between the action of the tropic acid molecule contained in atropine and stimulation of inhibitory nerve-structures, seems thereby clearly pointed out. The undoubted double action of atropine stimulating, as we believe, both inhibitory as well as vasomotor nerve-elements, may yet find a satisfactory explanation through a careful study of the relation existing between its chemical constitution and its physiological action.

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[1] Lehrbuch, T. Arzneimittellehre, etc.

LITERATURE OF THE PHYSIOLOGICAL ACTION OF ATROPIA ON THE HEART.—According to Dr. Lauder Brunton, atropia paralyzes the inhibitory nerve-ganglia. On page 48 of his work on *Pharmacology*, he states that both atropia and curare completely paralyze the motor or efferent nerves; but, while a very large dose of curare is required to paralyze the cardiac and vascular nerves, a very small dose suffices to paralyze those going to the muscles. On the other hand, an enormous dose of atropia is required to paralyze the nerves going to the muscles; while very small doses are sufficient to affect the nerves of the heart and of other involuntary muscles; so that we get rapid circulation, dilatation of the pupil, and restless delirium. On page 53 of the same work, we find it mentioned that atropia, in very minute doses, renders the pulse slow; that larger doses make it exceedingly rapid; and still larger doses render it slow again. The accelerator ganglia are said to remain uninfluenced by the drug. In the opinion of H. C. Wood and others, the latter ganglia are decidedly stimulated by atropia; and Dr. Roberts Bartholow, in the fifth edition of his treatise on *Materia Medica and Therapeutics*, page 435, states "that in some subjects a decided slowing of the heart takes place immediately after the administration of a considerable dose of it (hypodermatically), and in all, most probably, an instantaneous retardation of the pulse-rate; but a very decided rise in the number of pulsations quickly follows." Bartholow, like Wood, believes that atropia not only paralyzes the filaments of the vagus, but also stimulates the cardiac accelerator nerves.

The question naturally arises, How are we to account for this primary slowing of the heart's action which follows the administration of certain doses of atropia? Is it produced by the stimulating influence which the drug exerts upon the vagus-centre, or upon the peripheral filaments, or both? In the work of Dr. Lauder Brunton, already referred to, we find atropia, hyoscyamine, and daturine enumerated among those substances which are capable of stimulating the vagus-centre in the brain, but which paralyze the inhibitory ganglia within the heart.

The peculiar action of atropia might, therefore, be easily explained by its power of stimulating the vagus-centre. It has been experimentally proven by injecting atropine into the carotids, in which case it reaches the brain before it does the heart, and an invariable slowing has been found to take place when the drug is thus administered. But when atropia is administered hypodermatically, as it was in Bartholow's cases, it would naturally reach the heart before it would the brain, and should, accordingly, paralyze the terminal filaments of the vagi in the heart before it could stimulate their centres in the brain. In this manner, however, no slowing of the heart's action could take place, for after the terminal filaments of the vagus are once paralyzed, no amount of stimulation of its centres in the brain would produce the slightest effect. The view, therefore, which attributes to atropia a like action would seem clearly insufficient to account for all the phenomena observed.

Nothnagel and Rossbach[1] explain the phenomena as being due, not only to an excitation by atropine of the vagus-centres in the brain, but also to a similar influence on its terminations in the heart. According to these authors, the administration of large doses of atropine in man, the rabbit, and the frog, is always followed by a transient slowing of the pulse-rate, which is usually short in man, but which may at once culminate in diastolic arrest in other animals. These same authors further state it, as the result of numerous experiments, that the initial retardation is quickly followed by an acceleration of the pulse-rate, which may become from twice to three times that of the normal; they believe that finally we have paralysis of the inhibitory portion of the vagus nerves, so that their stimulation produces acceleration, rather than slowing.

This explanation by Nothnagel and Rossbach met with great opposition on the part of Harnack, according to whom the smallest doses of atropine produce paralysis of the inhibitory ganglia of the heart in warm-and cold-blooded animals alike; large doses, he said, paralyze the heart itself, but have a slightly irritating influence on it before paralysis occurs. The slowing of the heart's action is explained by Harnack as due to the paralyzing influence of atropia on the heart itself. Harnack is very decidedly against the view which admits that atropia stimulates the vagus in the heart; he even denies the correctness of the explanation given by Gnauck for the primary slowing in the heart's action produced by hyoscine as being due to a direct stimulation of the inhibitory ganglia by this drug.

The controversy seems not yet closed on this all-important point, although the majority of physiologists in Germany incline toward the explanation of the primary slowing given by Nothnagel and Rossbach, while American and English as well as French writers appear as yet slow in accepting it.

According to our conception of this question, there is no point in the whole history of the physiological action of atropia, the decision of which is of greater importance. Unless we know whether atropia paralyzes or stimulates the terminal filaments of the vagus, and under what conditions it exerts its influence, the administration of the drug cannot be said to rest on anything like a scientific basis. In reviewing the literature of the subject, we find the best authorities almost equally divided. The difficulty, therefore, of the correct solution of the question seems fully equal to its importance. No matter which of the two opposing views we may hold, we find ourselves supported by experimental evidence of the first quality, and neither is easily set aside. Thus the well-known experiments of Schmiedeberg and Koppe on the antagonism of atropine and muscarine, and those of Fraser on the antagonism between atropine and physostigmine, which latter were repeated and confirmed by Lauder Brunton, are, to all appearances, so strikingly exact as to bear almost incontrovertible testimony of the fact that atropine paralyzes, and at no time stimulates, the terminal filaments of the vagus. Still it must also be admitted that the fact that atropine antagonizes muscarine-standstill need not necessarily imply that atropine paralyzes and muscarine stimulates the inhibitory ganglia, and that all the phenomena observed depend absolutely on such action. Again, the fact that physostigmine restores the normal function of the vagus over the heart after the latter had been atropized, and artificial stimuli could not be conveyed to it through its fibres, does not necessarily imply that atropia had paralyzed and physostigmine restored the normal function of the inhibitory ganglia of the heart, and our experiments will show that even without physostigmine the function of the terminal filaments and ganglia of the vagus may be fully restored after atropization. No matter what the explanation may be, we may divide the action of atropia on the heart into three distinct stages, namely: (1) The primary slowing, followed (2) by an acceleration, which again is succeeded by (3) a second slowing, which may be either followed by a return to the normal, or terminate in diastolic arrest. These three well-marked stages have been observed by all those who have subjected the drug to careful experimentation. The slowing following the stage of acceleration has been commonly observed in all animals, since von Bezold and Blœbaum first called attention to it; and Mitchell, Keen and Morehouse, and other clinical observers have noticed its occurrence in man, in whom, as a rule, it returned to the normal. This stage, therefore, must be explained, as well as the first two stages, and exhaustion alone will not sufficiently account for it. In presenting the experiments, only those will be given which are typical.

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[1] Lehrbuch J. Arzneimittellehre, etc.

Exp. XXVI.—May 19, 1886. Small adult dog. Heart isolated at 3.20 P. M. under morphine and curare. Venous pressure 22 c. m. Arterial pressure equal to 140 m.m. mercury. Normal nutrient: defibrinated calf's blood. Atropine sulphate used in the proportion of 1 grm. dissolved in 4000 of calf's blood.

Time P. M.	No. of beats in 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	The circulating fluids were supplied to the heart at the time mentioned on the same line in the first column.
3.22	80	100	35°	Under normal blood.
23	80	100		
24	80	100		
25	81	102		
26	81	105	35	On atropized blood.
27	81	100		
28	66	85	...	On normal blood.
29	60 : 30	40	...	Auricles contracting twice, ventricles once.
30	60 : 30	0	...	Heart's action very irregular, pressure going down rapidly. Arrested in diastole; slight kneading still followed by solitary contractions.
31	...	0	35	

Exp. XXVII.—May 19, 1886. Small adult dog. Under morphia and curare. Heart isolated at 4.16 P. M. Venous pressure 22 c. m. Arterial pressure equal to 140 m.m. mercury. Normal nutrient: defibrinated calf's blood.

Time P. M.	No. of beats in 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	The circulating fluids were supplied to the heart at the time mentioned on the same line on the first column.
4.20	74	110	36°	Under normal blood.
21	74	112		
22	73	108		
23	73	108		
24	73	106	36	On atropized blood, 1 : 8000.
25	70	120		
26	67	126		
27	71	128	...	On normal blood.
28	70	136		
29	70	124	36	On atropized blood, 1 : 8000.
30	70	128		
31	65	138		
32	66	144		
33	67	136		
34	68	130	36.5	
35	68	126	...	On normal blood.
36	70	116		
37	72	102		
38	74	102	36.5	
39	72	102	...	On atropized blood, 1 : 8000.
40	72	130		
41	72	128		
42	71	130		
43	73	130		
44	73	90		
45	70 : 35	54	...	Auricle contracting twice, ventricle once.
46	62 : 28	20	...	Heart action irregular; distended.
47	...	0	37	Stopped pumping wound: pressure sinks; arrest quickly takes place; cutting away pericardium negative; slight kneading still followed by solitary contractions.

Exp. XXX.—Terrapin, 1605 grms. Calf's blood and Ringer's saline ($1:1\frac{1}{2}$). Inflow canulas in left superior vena cava and inferior vena cava. Outflow canulas in right aorta and pulmonary artery. Venous pressure 4 c. m. Arterial pressure 30 c. m.

Time P. M.	Rate per min.	Work in c.c. per min.	Temp. Cent.	
2.24	30	55	20°	
27	31	55		
32	31	56		
35	31	56	...	On atropized blood, 0.04 : 100 c. c.
36	31	52		
37	31	53		
38	30 : 15	56	...	Auricles contract twice to ventricles once.
39	30 : 15	55		
40	30 : 15	52		
41	30 : 15	52	20	On normal nutrient.
43	30 : 15	56		
44	30	57		
50	30	53		
57	32	52	...	On atropized blood, 0.03 : 100 c. c.
58	32	50		
59	31	49		
3.00	31	49		
03	30 : 15	?	...	Auricles contract twice, ventricle once.
05	30 : 15	53		
10	30 : 15	52		
15	31	53	20	
20	31	55		
25	31	54		
30	31	...	...	On atropized blood, 0.08 : 100 c. c.
35	31			
36	30 : 15	...	...	On normal blood mixture.
37	30 : 15			
38	30 : 15			
39	30 : 15			
40	30 : 15	20	...	Heart still in good condition. Experiment discontinued.

Exp. XXI.—May 12, 1886. Small adult dog. Under morphine and curare. Heart isolated at 2.38 P. M. Venous pressure 26 c. m. Arterial pressure 144

m. m. mercury. Calf's blood the normal nutrient. Homatropized blood used in different degrees of strength.

Time P. M.	No. of beats in 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	The circulating fluids were supplied to the heart at the time mentioned on same line in the first column.
2.49	81	146	35°	Under normal blood.
50	81	146		
51	81	142		
52	82	146		
53	82	148	35	On homatropized blood, 1 : 6000.
54	89	152		
55	86			
56	86	156	...	On normal blood.
58	82	150		
59	84	148		
3.00	86	144	36	
01	88	140	...	On homatropized blood, 1 : 6000.
03	88	164		
04	90	162		
06	89	173	...	On pure blood. .
07	89	173	37	
08	90	175	...	On homatropized blood, 1 : 6000.
09	91	180		
10	90	178		
11	88	174		
12	90	.....	...	On normal blood.
13	90	.....	37	
14	90	144		
16	90	136		
17	88	130		
18	89			
19	88	128	...	On homatropized blood, 1 : 2000.
20	86	86	37.5	
21	84	74	...	On normal blood.
22	84	106		
23	84	114		
24	84	128	37.5	
25	84	140		
26	83	140		
27	85	140		
28	85	139	...	On homatropized blood, 1 : 4000.
29	85	120	38	
30	84			
31	84	120		
32	82	120		
33	83	120		
34	84	122	38	
35	84	124		
36	83	112		
37	82	106		
38	82	98	38	
39	82	96		
40	82			
41	81	94		
42	80	82	38	
43	80	82	...	On normal blood.
46	82	78		
48	82	77		
50	81	74		
51	81			
52	82	96	...	On homatropized blood, 1 : 4000.
53	84	80	38	
54	84	76		
55	83	70		
56	84	66		
57	85	56		
58	86	54		
59	87			
4.00	84	40		
01	84	32		
03	82	24	...	Beginning irregular heart's action.
05	76	10	...	Great distention, followed by arrest. Slight kneading followed by single, though ineffectual contractions.

In Experiment XXVI. very strongly atropized blood was used, and the effect produced by it was, accordingly, very marked. During the first five minutes of observation, while the heart was working under normal calf's blood of the temperature of 35° Cent., the rate kept at 80 to 81 beats per thirty seconds, and the amount of blood pumped round in half a minute varied from 100 to 105 c. c. From 3 h. 26 m. to 3 h. 28 m., judging from the quantity of blood which ran through the heart during these two minutes, the latter had been exposed to the influence of about 0.05 grm. of the sulphate of atropia. The rate was quickly reduced from 81 to 66 beats in thirty seconds, the work done from 105 c c. to 40 c. c. for the same period of time; then the heart's action became irregular, the auricles beating at the rate of 60 times to the ventricle 30 times, the work being *nil;* at last the action of the heart became still more irregular, the pressure suddenly went down, and diastolic arrest ensued, mechanical stimulation, however, still being followed by single, and not very powerful contractions. This is the typical result which follows the admission of strongly atropized blood into the mammalian heart.

In Experiment XXVII. atropized blood of only half the strength of that used in the preceding experiment was employed, and the result, as may be seen, is quite different. An increase, instead of a decrease, in the amount of work done may be noticed, accompanied by a slight decrease in the rate, followed by an attempt on the part of the latter to return to the normal. All this occurs while atropized blood is still circulating through the heart, but becomes much more apparent after this is withdrawn, and normal blood is again allowed to flow through. Finally, after repeated atropization, we obtain the effect of large doses of atropine on the heart, namely, rapid reduction of rate and work, irregularity in its action, and arrest in diastole.

In these, as well as in other similar experiments, after diastolic arrest was apparently complete, gentle kneading of the ventricle was still followed by contractions, showing that the muscular substance of the heart was still in possession of a certain amount of irritability.

In all the experiments made with homatropine on the mammalian heart, its effects were found to be identical with those of atropine used in very small doses. Its influence upon the inhibitory nerve-apparatus of the heart is decidedly less powerful than that of atropine, which is in apparent accordance with its effect upon the pupil, which is but transient when compared with that of atropine. Experiment XXI. has been selected to represent the typical action of homatropine on the mammalian heart, as well as that of very small doses of atropine. An examination of this experiment shows that during the first three observations which were made with homatropized blood, the rate is slightly increased, and the work done very considerably augmented. Homatropized blood of the strength of 1 : 2000, however, invariably reduces both rate and the work done, while when it is used in the proportion of 1 : 4000, or even less strong, it produces the opposite effect. Blood of this strength was kept circulating through the heart for 15 minutes, and, while no increase in the rate or the work done was noticed, both were only very slowly and gradually reduced, the former from 85 to 80, the latter from 140 to 82 c. c. per 30 seconds. Atropized blood of the same strength in all the experiments made with it on the mammalian heart, never failed to produce diastolic arrest within three to four minutes. The most marked feature, however, in the effect produced by very small doses of atropine or medium doses of homatropine, is an acceleration in the heart's action, followed by a slowing, instead of, as is the case with the medium doses of atropine, at first a slowing, followed by an increase in the rate. This apparently contradictory result will be explained satisfactorily later on.

Experiment XXX. on the heart of the terrapin, represents but a portion of an experiment published elsewhere, but which, nevertheless, may with propriety be reproduced here, for the reason that it represents in a typical manner the effect produced by large drops of atropine on the heart of cold-blooded animals. The point which it is desirable to emphasize, is the reduction, by certain definite doses of atropine, of the rate of the ventricle, that of the auricles, though much weakened, remaining numerically unchanged. It happens, after atropized blood of about the strength of that used in this experiment has circulated through the heart a certain length of time, that there follows a period during which the rate of the ventricle becomes just half that of the auricles. This change in the ventricular rate comes on suddenly as a rule. After awhile, however, atropized blood being kept on, the ventricular rate is still further reduced, and, finally, diastolic arrest of the entire heart ensues. During this stage of atropization, the ventricle is from twice to three times its normal size, but the work done, in spite of the reduced rate of contraction, is generally increased. In some of my former experiments with regard to this point, published in the *Proceedings of the U. S. National Museum for* 1855, the work done by the heart during this stage is increased 100 per cent. Atropized blood being withdrawn and normal blood readmitted, the ventricle, after a short time, will be found to resume its normal number of contractions in as prompt a manner as it passed from the normal to the reduced rate. This singular phenomenon may be reproduced many times during the course of a single experiment, and the dose of atropine producing it, so graduated as to keep it up any desired length of time.

It is a remarkable fact, that very small doses of the drug never produce this effect. Atropized blood, mixed in the proportion of 1 : 10,000, may be allowed to circulate through the heart for several hours in succession, and no such result will follow, even if the heart, during that time, has been exposed to the influence of a much larger total amount of atropia than would suffice to produce it when used in a more concentrated form. Under these circumstances the rate is increased from three to five beats per minute, the size of the entire heart undergoes great reduction, its systole is lengthened, its diastole correspondingly shortened, the work done greatly reduced in amount. This condition may go on until it almost resembles one of systolic arrest, the diastole becomes completely abolished, and no blood whatever is being pumped around. Small doses of atropine, therefore, produce an apparently opposite result from that which is produced by large doses, and this is a point upon which it is desired to lay particular stress in this connection.

Thus Bowditch and Luciani found the contractions both of the frog's heart containing the ganglia and of the apex alone, were rendered more powerful by atropine, while Gnauck, on the contrary, found that the contractions of the ventricle were diminished both by atropine and hyoscyamine. Kronecker and Schapiro believed that they had found that both these apparently contradictory results were correct, but at different temperatures. They state that when the temperature is low (70–80° C.) the ventricular contractions are enlarged by atropine, but diminished by it when the temperature rises above 15° C. We believe that this explanation is insufficient, if not entirely wrong. The phenomena observed by Kronecker and Schapiro depend entirely on the temperature of the heart, or the circulating medium, and have little or nothing to do with the action of atropine on that organ.[1] From the experiments which are here published, as well as elsewhere, it is, I think, clear that the difference in the character of the contractions observed by Bowditch and Luciani on the one hand, and Gnauck on the other, as to the effect of atropine on the heart, is a matter of *dose of the drug* rather than of temperature. In experimenting on the heart with circulating media of different degrees of temperature, it will be found that those of low temperature will cause a reduction in the rate as well as an increase in the size of the contractions, and *vice versa*. The heart, therefore, in this respect, and under the influence of blood of different degrees of temperature, behaves somewhat similar to what it does when under the influence of different doses of atropine, larger doses of atropine corresponding in their effect to circulating media of low temperatures, the smaller ones to circulating media of higher temperatures, and this, perhaps, explains the errors made by Kronecker and Schapiro.

EXP. XII.—April 29, 1886. Dog, 5400 grms. Under morphine and curare. Heart isolated at 4.35 P. M. Calf's blood. Venous pressure 16 c. m. Arterial pressure 138 m. m. mercury at start. Hyoscinized blood, 1 : 4000

Time P. M.	No. of beats per 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	
4.39	85	75	40°	Under normal blood.
40	85	75		
41	85	75		
42	84	76		
43	85	78	40	On hyoscinized blood.
44	80	50		
45	78	34		
46	74	26	...	On normal blood.

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[1] See the author's explanation of the influence of blood in different degrees of temperature on th heart of the terrapin.—Proc. U. S. Nat. Mus., 1885. Washington, D. C.

Time P. M.	No. of beats per 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	
4.47	80	40	40°	
48	78	44		
49	78	64	...	On hyoscinized blood.
50	70	33	...	On normal blood.
51	74	30		
52	75	30	40	
53	75	30		
54	74	28		
55	73	26		
56	73	28	...	Arterial pressure fixed at 124 m. m.
57	73	30		
58	73	30	40	On hyoscinized blood.
5.00	67	...		
01	66	13	...	On normal blood.
03	65	24		
04	63	20		
05	63	...		
06	62	24		
08	60	28	40	On hyoscinized blood.
10	58	16		
12	58	8	...	On normal blood.
13	57	0		
14	56	0	...	Arterial pressure fixed at 100 m. m.
16	59	6		
17	64	4		
19	62	0	...	Stopped pumping wound; pressure sinking gradually.
20	60	0		
21	55	0		
22	53	0		
23	51	0	...	Heart greatly distended. Final arrest in diastole.

Exp. XI.—April 29, 1886. Dog, 4970 grms. Under morphine and curare. Heart isolated at 3.10 P. M. Venous pressure 18 c. m. Arterial pressure 150 m. m. mercury. Calf's blood. Hyoscinized blood, 1 : 6000.

Time P. M.	No. of beats per 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	
3.16	95	86	38.5°	Under normal blood.
18	94	85		
20	95	85	39	On hyoscinized blood.
21	90	76		
22	86	62		
23	84	60	...	On normal blood.
24	90	56		
26	95	80	39.5	
28	96	76		
29	95	72		
31	94	71		
33	94	71		
34	94	68	40	On hyoscinized blood.
35	89	60		
36	88	50		
37	88	32	...	On normal blood.
39	86	...	40	
40	86	10	...	Pressure begins to go down.
41	85	0	...	Stopped pumping wound.
42	80	0	40	Heart in diastolic distention; arrest.

Exp. XXXI.—May 25, 1886. Small adult dog. Under morphine and curare. Heart isolated at 2.22 P. M. Calf's blood. Venous pressure 18 c. m. Arterial pressure 136 m. m. mercury. Hyoscinized blood contained 1 grm. of the drug in 800 c. c. of calf's blood.

Time P. M.	No of beats per 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	
2.31	86	60	35°	Under normal blood.
32	86	58		
33	88	60		
34	88	62		
35	88	65	35.5	On hyoscinized blood.
36	93	50		
37	92	53	...	On normal blood.
38	90	55		
39	94	70		
40	95	70	35.5	
42	97	68	...	On hyoscinized blood.
43	97	60		
44	99	24	...	On normal blood.
45	103	0	...	Stopped pumping wound.
47	0	0	36	Pressure rapidly sinking; arrest in diastole.

Exp. XXVII.—March 4, 1886. Terrapin, 890 grms. Beef's blood and Ringer's saline (1 : 1). Canulas as usual. Venous pressure 6 c.m. Arterial pressure 16 c.m. Hyoscinized blood (*a*) 0.03 : 100 c.c.; (*b*) 0.25 : 100 c.c.; (*c*) 0.5 : 100 of normal blood mixture.

Time P. M.	Rate per min.	Work in c.c. per min.	Temp. Cent.	
3.20	32	14	18°	Under normal blood mixture.
25	32	14		
30	32	14		
35	32	15		
40	32	15	18	On hyoscinized blood (*a*).
41	35	16		
42	33	16		
43	31	13		
44	31	12		
45	30	12		
46	30	12	...	On normal blood mixture.
55	32	20	19	
4.00	32	15		
03	33	17		
06	33	16	...	On hyoscinized blood (*b*).
07	32	15		
08	32	14		
09	31	11		
10	30	11		
11	28	10		
12	28	11		
13	26	11	20	
14	25	11		
15	25	10.5		
16	25	12		
17	25	13		
18	25	12.5	20	
19	25	12.5	...	On normal blood mixture.
20	25	12.5		
21	25	12		
22	25	13		
24	28	13		
28	29	15		
32	31	13		
36	32	14	...	On hyoscinized blood (*c*).
37	31	13		
38	30	11		
39	28	10		
40	26	10		
41	25	7		
42	24	7		
43	24	6		
44	24	5		
45	24	4		
46	23	3.5	...	Auricles largely distended ; contractions barely
47	23	3		[perceptible.
49	22	3	...	Heart's action getting to be irregular. Obser-
55	20	1	21	[vations discontinued.

In Experiment XII. on the heart of the dog, hyoscine was used in the proportion of 1 grm. of the drug dissolved in 4000 c. c. of defibrinated calf's blood. The first observation with blood of this strength shows a decrease in the rate of 9 beats in 30 seconds, or 18 beats per minute, and a total decrease in the work done of 52 c. c. per 30 seconds, or 104 c. c. per minute. The maximum reduction of both rate and work was reached after hyoscinized blood had run through the heart three minutes. Upon the readmission of pure blood, the rate went up to 80 per 30 seconds, or 6 beats, but finally remained at 78; the amount of work done was increased from 26 to 64 c. c. Hyoscinized blood being again turned on, for only one minute, the rate went down suddenly from 78 to 70 and the work done from 64 to 30 c. c. in 30 seconds. Pure blood now readmitted, though slightly increasing the rate, did not give rise to a corresponding increase in the work. During the entire experiment with hyoscine the rate of the heart was reduced from 85 beats to 51 beats per 30 seconds, the temperature of the circulating blood varying 1° C., being 40° at the beginning and 39° at the end. The heart was finally arrested in diastole, the muscular walls still responding to mechanical stimulation.

In Experiment XI. hyoscine was used in the proportion of 1 grm. to 6000 c. c. of calf's blood. The effect which is produced on the rate is quite as decided as in the preceding experiment, while the work done does not experience the same amount of reduction.

In Experiment XXXI., in which hyoscine was used in the proportion of 1 : 8000, the result, as may be seen, is quite different. An increase instead of a decrease in the rate follows the admission of hyoscinized blood into the heart; the work, however, is slightly decreased. This is the usual result obtained with hyoscine used in this proportion. Out of three experiments including eleven observations, an initial increase in the work done was noticed only once.

In Experiment XXVII. on the terrapin we have an illustration of the effects of both large and small doses combined; the latter causing an increase in the rate and the amount of work done in a given time, the former giving rise to a decided decrease in both.

Comparing the effect of hyoscine with that of atropine on the heart, the great similarity with which both influence that organ must be apparent. The only difference which is noticed is a quantitative not a qualitative one. Both, no doubt, stimulate the vasomotor as well as the inhibitory ganglia and their nerve filaments. Atropine, however, seems to have a somewhat more powerful influence on the vasomotor portion of the nerve apparatus than hyoscine has; besides, hyoscine does not seem to stimulate the muscular substance to the same extent as is done by atropia. Both resemble each other in that larger doses are required to produce inhibitory excitation, and smaller ones only suffice to stimulate the vasomotor ganglia. As in the case of atropine, diastolic arrest is brought about by stimulation of the inhibitory nerve apparatus and the accompanying musculo-motor exhaustion.

Exp. VII.—April 27, 1886. Dog, 5445 grms. Under morphine and curare. Heart isolated at 3 P. M. Calf's blood. Venous pressure 15 c. m. Arterial pressure 134 m. m. mercury. Hyoscyamized blood, 1 : 4000.

Time P. M.	No. of beats per 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	
3.08	60	80	34°	Under normal blood.
09	60	80		
10	63	75		
11	65	70		
13	70	65	35.5	
15	70	65		
16	70	60		
17	69	65	...	On hyoscyamized blood.
18	61	49	36	
20	60	35		
22	60	30	...	On normal blood.
23	70	22		
25	71	46		

Time P. M.	No. of beats per 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	
3 27	72	44		
29	71	42	...	On hyoscyamized blood.
31	62	25		
33	57	15		
35	51	0	...	Stopped pumping wound; pressure going down quickly; great distention. Final arrest in diastole. Gentle kneading still followed by contraction.
38	48	0		

Exp. XXXII.—May 25, 1886. Small dog. Under morphia and curare. Heart isolated 3.40 P. M. Venous pressure 22 c. m. Arterial pressure 136 m. m. mercury. Calf's blood. Hyoscyamized blood 1 : 8000.

Time P. M.	No. of beats per 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	
3.47	100	110	37.5°	Under normal blood.
48	100	108		
49	100	110		
50	100	112		
51	100	112	37.5	On hyoscyamized blood.
52	94	162		
53	92	158	...	On normal blood.
54	91	98		
55	91	100		
56	91	100	38	
57	91	100	...	On hyoscyamized blood.
58	91	110		
59	92	114		
4.00	92	118	39	On normal blood.
01	92	112		
02	92	102		
03	93	106	...	On hyoscyamized blood.
04	92	80	39	
05	92	68		
06	92	14	...	On normal blood.
07	100	0	...	Stopped pumping wound ; pressure rapidly sinking. Diastolic arrest quickly followed.
08	102	0	39	

Exp. XL.—June 2, 1886. Small adult dog. Under morphine and curare. Heart isolated at 3.40 P. M. Venous pressure 22 c. m. Arterial pressure 150 m. m. mercury. Calf's blood. Hyoscyamized blood, 1 : 8000.

Time P. M.	No. of beats per 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	
3.44	92	140	40°	Under normal blood.
45	92	140		
46	93	140		
47	94	142	...	On hyoscyamized blood.
48	93	152	40	
49	93	148		
50	88	140		
51	88	138		
52	88	138	40.5	On normal blood.
53	88	132		
54	89	138		
55	90	146		
56	90	143	...	On hyoscyamized blood.
57	86	156		
58	91	148	41	
59	91	138	...	On normal blood.
4.00	92	140		
01	92	140		
02	93	142		
03	93	150	41	
04	93	156	...	On hyoscyamized blood.
05	90	164		
06	91	136	...	On normal blood.
07	92	100	...	Beginning irregularity in the rhythm.
08	92	0	41	Stopped pumping wound ; arrest.

Exp. VI.—January 23, 1886. Frog, 110 grms. Beef's blood and Ringer's saline (1 : 1). Inflow canula in inferior vena cava. Outflow canulas in two aortic trunks. Venous pressure 4 c. m. Arterial pressure 12 c. m. Hyoscyamized blood, (*a*) 1 : 10,000, (*b*) 1 : 5000.

Time P. M.	Rate per min.	Work in c.c. per min.	Temp. Cent.	
4.00	35	9	18°	Under normal blood mixture.
05	35	9		
10	35	9		
15	35	9	...	On hyoscyamized blood (*a*).
17	40	9	18	
19	40	9.5		
21	38	11		
23	35	10		
25	35	10	18	
30	35	10		
35	33	10		
40	33	10	18	
44	30	9	...	On normal blood mixture.
46	34	9		
50	34	9		
55	36	8.5		
59	36	8.5	18.5	On hyoscyamized blood (*b*).
5.01	44	10		
03	41	9.5		
07	38	9		
11	35	8 5		
15	35	8	18.5	
20	35	8		
25	34	7 5		
30	34	7	...	On normal blood mixture.
35	31	7		
40	31	7		
45	35	8		
50	35	8.5		
55	35	9	19	Observations discontinued.

In Experiment VII. hyoscyamine was used in the proportion of 1 : 4000. During the first observation with hyoscyamized blood, the rate was reduced 9 beats per 30 seconds, and the work done was decreased from 60 c. c. to 30 c. c. for the same interval. Pure blood being now turned on, the rate promptly returned to the normal, the work, though increasing somewhat, did not again reach the normal amount. The result of the second observation with hyoscyamized blood was a reduction in the rate from 69 to 48 beats per 30 seconds and the work became nil. The heart, especially the ventricle, was largely distended, stopped pumping around, the pressure quickly went down and diastolic arrest followed.

In Experiment XXXII. hyoscyamine was used in the proportion of 1 : 8000. We notice here also a reduction of 4 beats in the rate during the first minute and of 3 additional beats per 30 seconds, during the following two minutes. The reduction in the rate takes place much more gradually in this experiment than in the preceding one, due to the diminished strength of hyoscyamized blood. The later observations show an increase in the rate. The work is increased in the beginning and decreased toward the end of the experiment when the heart is arrested in diastole.

In Experiment XL. we again find at first a decrease and then an increase in the rate due to hyoscyamized blood. This observation is of great importance, and throws considerable light on the character of the action of hyoscyamine on the heart. Hyoscyamine, like atropine, excites both inhibitory and accelerator nerves, the latter being influenced by comparatively small doses which, however, are themselves insufficient to affect the inhibitory apparatus. On the other hand, when the dose of the drug, applied to the heart, happens to be sufficiently large to stimulate both these nervous structures alike, inhibitory stimulation becomes manifest before that of the accelerator nerves in the same manner as this occurs when electrical stimulation is applied. Hence the primary decrease, as due to the action of hyoscyamine, being followed by a subsequent rise in the rate of the heart.

Experiment VI. on the heart of the frog, shows an initial increase in rate followed by a decrease below the normal. Small doses invariably give rise to an increase in the rate, but if hyoscyamized blood is allowed to run through the heart for a longer time than is sufficient to produce the maximum increase, the rate begins to fall as under larger doses, so that, in this experiment, we have the effects of small as well as large doses. As a rule, the mammalian heart reacts much more promptly than does that of cold-blooded animals.

Exp. XIX.—May 11, 1886. Dog, 9750 grms. Under morphia and curare. Heart isolated 2.38 P.M. Venous pressure 16 c.m. Arterial pressure equal to 146 m.m. mercury. Calf's blood the normal nutriment. Daturine used in the proportion of 1 : 8000.

Time P. M.	No. of beats in 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	The circulating fluids were supplied to the heart at the time mentioned on the same line in the first column.
2.41	83	116	36°	Under normal blood.
43	83	115		
44	82			
45	82	115		
46	82	115	36	On daturine blood.
47	85	100		
48	86	100		
49	82	100	...	On normal blood.
50	85	100	36	
51	85	102		
52	89	104		
53	90	102		
54	92	102		
55	96	104		
57	96	110	...	On daturine blood.
58	97	94	37	
59	96	70	...	On normal blood.
3.00	94	70		
01	95	70		
02	96	90		
03	95	109		
04	96	109		
05	97	110	38	On daturine blood.
06	95	90		
07	95	75		
08	93	65	38	On normal blood.
09	93			
10	93	68		
11	93	70		
12	92	80		
13	91	...	38	
14	91	85		
15	91	90		
16	92	...	...	On daturine blood.
17	89	55	38	
18	88	50		
19	86	45		
20	84	20		
21	84	0	38	Heart's action becoming irregular; stopped pumping wound; great dilatation, followed by sudden arrest in diastole.

Exp. XXIII.—February 24, 1886. Terrapin, 960 grms. Beef's blood and Ringer's (1 : 1). Canulas as usual. Venous pressure 7 c.m. Arterial pressure 18 c. m. Daturine blood, (*a*) 0.01 : 100 c. c., (*b*) 0.02 : 100 c. c., (*c*) 0.04 : 100 c. c.

Time P. M.	Rate. per min.	Work in c.c. per min.	Temp. Cent.	
3.00	35	25.5	...	Under normal blood-mixture.
05	35	26		
15	35	26		
20	36	25		
25	36	25		
30	36	24		
36	36	24	...	On daturine blood (*a*).
37	38	40		
38	36	47		
39	35	40		
40	35	32	...	On normal blood-mixture.
42	36	38		
50	36	38		
55	36	38		
4.00	36	37		
05	37	39		
10	37	40		
15	36	41		
18	36	40	...	On daturine blood (*b*).
19	38	45		
20	36	35		
21	36	35		
22	34	26		
23	33	25		
24	31	28	...	On normal blood-mixture.
25	31	37		
26	30	43	22.5°	
27	31	41		
29	29	45		
35	32	50		
40	33	40		
45	35	41		
50	36	40		
55	36	39	...	On daturine blood (*c*).
56	38	42		
57	34	37		
58	32	30		
59	30	27		
5.00	29	24		
03	24	20		
05	26	18		
07	26	18	...	On normal blood-mixture.
09	26	15	...	Auricles greatly distended; barely perceptible [contractions.
15	27	22		
20	28	27		
25	29	28		
30	30	30	...	Auricles almost recovered.
35	32	33	...	Observations discontinued.

Three experiments were made with daturine on the dog's heart, from which No. XIX is selected as representing what occurred in all. Small doses cause a slight increase, large ones a decrease in the rate. Out of the ten observations with daturine, divided between three experiments, a slight increase in the work occurred but once on small doses, which, although giving rise to an increase in rate, as a rule, decrease the amount of work done.

As shown in Experiment XXIII. on the terrapin, a slight initial increase in the rate occurs every time daturine blood is admitted into the heart. The increase in the work amounts at times to 100 per cent., the decrease coming on only after daturine blood has been kept circulating through the heart for a long time, this being equal to the effects of large doses, which latter, when applied to the heart at once, always reduce the rate very considerably. In the terrapin the auricles seem to become paralyzed long before the ventricle does when weak blood has been flowing through the heart for a long time. Strong daturine blood produces diastolic arrest of auricles and ventricle simultaneously.

Before discussing the phenomena as observed in the foregoing experiments, it will be necessary to review briefly some of the important fundamental points in relation to the innervation of the heart, more especially in the light of the more recent researches on the sympathetic nervous system by W. H. Gaskell.[1]

According to the views most generally received, the heart of both cold- and warm-blooded animals contains three kinds of nervous ganglia, endowed with different functions, namely: motor ganglia, accelerator ganglia, and inhibitory ganglia. The motor ganglia are supposed to be connected by an intermediate apparatus with the inhibitory ganglia on the one hand, and by a similar apparatus with the accelerator ganglia on the other; the former retarding or stopping, the latter accelerating or augmenting the muscular contractions presided over by the motor ganglia.

The researches of Gaskell appear to have placed the existence of at least two such ganglionic masses within the heart, beyond any possible doubt, and these are the inhibitory and accelerator or augmentor ganglia. Gaskell has shown conclusively that both accelerator and inhibitory nerve-fibres go to the heart in cold-blooded animals, as well as in mammals. "The vasomotor (accelerator or augmentor) nerves of the heart," according to Gaskell, "originate in the spinal cord, passing from it in the rami viscerales of the second and third and lower thoracic nerves, as fine medullated nerve-fibres, upward into the ganglion stellatum. From the ganglion stellatum, they either pass directly to the heart or else reach that organ from the annulus of Vieussens and the inferior cervical ganglion."

"When examined in their passage from these ganglia, they are found to be, without exception, non-medullated. These cardiac fibres, then, pass into the ganglion stellatum (ganglion cardiacum basale of Gaskell and Gadow) as fine medullated nerve-fibres, and pass out of it as non-medullated fibres. Their stimulation produces acceleration and augmentation in the heart's action."

"The cardio-inhibitory nerves," according to the same author, "leave the central nervous system in the rami viscerales of the vagus and accessory nerves, retaining the same fine medullated nerve-structure until they reach the heart, where they enter into connection with the ventriculo-auricular ganglia or Bidder's ganglia, and cannot be traced further, the nerves proceeding from these ganglia being almost entirely composed of non-medullated fibres; their stimulation either retards or altogether stops the heart's action."

We have, therefore, not only physiological proof of the existence of these two kinds of nervous structures, but Gaskell has also added histological proof, which never before had been made out so clearly as was done by him.

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[1] Journal of Physiology, vol. vii., No. 1.

Both inhibitory and accelerator nerves being efferent nerves, it now remains for us to pass briefly in review what is known with regard to the afferent nerves of the heart.

The well-known depressor nerve of Ludwig and Thiry carries stimuli from the heart to the brain, and stimulation of its central end produces all the phenomena which ordinarily follow stimulation of inhibitory nerves; its connection with the vaso-inhibitory centre in the brain is, therefore, rendered more than probable. Fibres are also supposed to run within the vagus which cause reflex contraction of the vessels and rise of blood-pressure; these are called the "pressor fibres." According to Lauder Brunton, the depressor fibres of the vagus seem to act on the vasomotor system through the medulla itself, while the "pressor fibres" affect it through a centre in the brain, so that, when the brain is perfect, irritation of the central end of the vagus causes increased contraction of the vessels and increased blood-pressure; but, when the brain is removed, or its function abolished by opium, it causes dilatation of the vessels, and a decrease in the blood-pressure. Most all the sensory nerves of the body may, however, affect the heart reflexly.

Drugs or other stimuli, accordingly, may affect the heart's action in either one or all of the following ways, viz.: (1) *Reflexly*, or through irritation of some sensory nerve; (2) *indirectly*, or through irritation of certain centres in the brain; and (3) *directly* through their influence on the heart and its contained ganglia.

In experimenting with drugs on the isolated heart, we can, of course, only speak of their direct action on that organ, and to this our further discussion on the subject will be confined.

In studying the foregoing experiments, we find, in the first instance, that the enormous acceleration which follows the administration of certain doses of atropine, and which forms so conspicuous a symptom in the second stage of atropine poisoning, is absent. If, however, as Harnack believes, the very smallest doses of atropine are sufficient to paralyze the terminal filaments of the vagus, and that their paralysis is the cause of the great increase in the number of pulsations, then, it would seem that there is no reason why this occurrence should not take place in the isolated heart as well as in that of the intact animal. We find, on the contrary, that the smallest doses of atropine, in the mammalian heart, increase the number of contractions only from four to twenty beats per minute, and in that of cold-blooded animals about five beats.

From a careful examination of the results of our experiments in regard to this point, we have come to the conclusion that the smallest doses of atropine which in the intact animal give rise to a great increase in the number of pulse-beats, do not only not paralyze the filaments of the vagus, but also are quite insufficient to stimulate them—in other words, leave these structures quite intact. By small doses of atropine the vasomotor apparatus alone is stimulated, and the vagus, though also capable of excitation in much less time even than the vasomotor nerves, requires a much stronger stimulus to excite it. It is well known that, when a stimulus is applied to both these nerve-structures which is sufficiently strong to excite them, the vagus nerves would be the first to respond, and the vasomotors last. This is exactly what takes place when atropized blood is allowed to circulate through the heart of sufficient strength to excite them both. Under these conditions we obtain, first, a decrease in the frequency of pulsations, and afterward the latter will approach the normal once more, or may even exceed that number. This is shown in almost every experiment which we have made. While, however, it takes a stronger stimulus to excite the vagus, the vasomotors, though slower in responding, are aroused by much weaker stimuli, and, therefore, capable of much greater excitation than the vagus by the same stimuli, and hence the probability is very strong in favor of the latter being inhibited to the extent that the vasomotors are over-stimulated.

So far, we have found no evidence in favor of the paralyzing action of atropine on the terminal filaments of the vagus, but, on the contrary, have every reason to believe that these structures are excited by this drug, and Rossbach and Fröhlich are, in our opinion, perfectly correct in believing that the primary slowing in the heart's action due to atropine is caused, in part, by the stimulating influence which the latter exerts on the terminal filaments of the vagus within the heart. This stage does not become apparent on small doses being used, and, for this reason, it may have been overlooked by some.

The second stage, or that stage in which there is more or less acceleration in the heart's action, is, therefore, due to vasomotor stimulation only; this will be the greater, the smaller the dose of atropine used. With doses even slightly larger than are sufficient to excite the vagus simultaneously with the vasomotors, there will be either no acceleration at all or the number of beats above the normal will be very small. This is well shown in those experiments in which extremely small doses of atropine were used, but in which their influence was extended over a long period and the effect of larger doses was, finally, attained. Here we invariably noticed an acceleration followed by a slowing in the pulse-rate. Therefore, according to our interpretation, even during the stage of acceleration the vagus filaments are not paralyzed, but, if at all affected, they must be excited, the stimulation of the vasomotor apparatus being capable of much more intense stimulation than the inhibitory, simply gains the mastery, though for a short period only. In the experiments which were made on cold-blooded animals with very small doses, a condition of the heart was reached after a certain time which was almost identical with systolic arrest. The ventricle gradually became one-third its normal size, and the auricles diminished in about the same proportion, so that no blood entered the heart and none was consequently pumped around. This would be exactly what we should expect to find, if the stimulation of the vasomotor apparatus of the heart was unantagonized by inhibitory stimulation, and this condition may obtain in the case of atropine being used in very small doses, or when very weak atropized blood flows through the heart a certain length of time, which is insufficient to excite simultaneously the inhibitory apparatus. A further proof of the fact that atropine does not paralyze the vagus filaments, is found in those experiments in which very small doses of the drug having repeatedly produced an acceleration in the pulse-rate, large doses still produced the slowing which is characteristic of them. If the ganglia and filaments of the vagus had been paralyzed by small doses of atropine, it would not have been possible to excite them afterward with slightly larger doses. According to the strength of atropized blood which is allowed to flow through the heart, we may produce either acceleration or slowing; the former is invariably brought about by small doses, the latter by larger doses of the drug. The fact that either may be produced alternately several times during one experiment and on one animal, seems strong proof in favor of small doses of atropine not paralyzing the inhibitory nerves, and of larger doses stimulating instead of paralyzing the structures. The increase in the amount of work done during a certain stage of atropine-poisoning seems to be another proof in favor of this view of the subject. Vasomotor stimulation, pure and simple, causes the heart to beat more frequently, at the same time shortens the diastole and diminishes the carrying capacity of the ventricle, so that a decreased amount of work would be what we should expect to find under these conditions. We find, however, that the amount of work is increased during a certain stage of atropization; this stage is of short duration in the mammalian heart, but lasts much longer in the heart of cold-blooded animals. The immense amount of work which is done during this stage is due to the presence of inhibitory as well as vasomotor excitation, the former favoring the relaxation of the ventricle, hence increasing its capacity; the latter giving rise to increased frequency in the contractions; or in case the latter are decreased in number, as is the case when the inhibitory stimulation is about to gain the mastery, simply adds the extra amount of force required to pump around the abnormally large amount of blood, without increasing the number of the contractions. As soon, however, as the increased number of cardiac contractions gives way to a decrease, we also know that inhibitory excitation is beginning to gain the upper hand, and, unless the heart is quickly withdrawn from under the influence of atropine, diastolic arrest is certain to follow in a short time. This is the condition which prevails during the so-called third stage of atropine poisoning. Our experiments show that the heart may recover perfectly from this condition, when atropized blood is withdrawn and pure blood is admitted, in time to prevent complete vasomotor exhaustion. The action of atropine being kept up, the heart is finally arrested in diastole as a consequence of vasomotor exhaustion from overstimulation and of inhibitory excitation. The muscular substance of the heart still responding to mechanical irritation even after diastolic arrest is complete, the order in which the different structures composing the heart are paralyzed is probably as follows: First, the vasomotor ganglia and their filaments. Second, the inhibitory ganglia and their filaments. Third, the muscular substance. Thus far, then, all the phenomena observed on the heart under the influence of atropia have been explained by the stimulating influence of the latter on the inhibitory and vasomotor nerve apparatus alone, and without the assumption of the inhibitory nerve apparatus being paralyzed at any time before diastolic arrest is produced. If, however, atropine stimulates the inhibitory nerve structures of the heart, it would seem that it ought also to stimulate these structures in organs other than the heart. The question now arises, What evidence have we of the stimulating influence of atropine on the inhibitory nerve elements supplying organs other than the heart?

When we take into consideration the large amount of work which the heart has to perform, and the powerful contractions which it has to execute constantly, it must become apparent, even without any other evidence to favor the view, that the vasomotor nerve-supply of this particular organ must be enormous when compared to that of other organs. This fact, therefore, must be kept in mind when we attempt to compare the effect of atropine on other similarly innervated organs to that which this drug exerts upon the heart. The pupil and the small intestine are examples of organs which are capable of contraction and relaxation. These organs, like the heart, are supplied with both motor and inhibitory nerve ganglia, but it is not at all likely that, quantitatively, their motor nerve supply is in any degree as great as that of the heart, and therefore the influence of atropine on the nervous structures of these organs cannot form so prominent a feature as it does in the case of the heart. This, of course, must also be true to a certain extent, at least, of the inhibitory nerves going to these organs. Smaller doses of atropine must, therefore, suffice to produce the characteristic effects of the drug than are required in the case of the heart. Nevertheless, in every other respect and if the interpretation of the nature of the action of atropia upon the automatic nerve ganglia of the heart, which is here given, be correct, and it is further to be presumed that the same stimuli must naturally affect allied organs, the histological structure and physiological function of which is similar, alike, or nearly so, then the evidence ought not to be wanting which favors the similarity or identity of the action of atropine on these organs with that which the latter drug has upon the heart.

With regard to the pupil, Gaskell says:

> "It is a striking and highly suggestive fact that the anatomical course and the histological characters of the nerves which dilate the pupil, are precisely similar to the inhibitory nerves of the circular muscles of the intestines, etc., which run in the abdominal splanchnics. In both cases they leave the central nervous system in the thoracic outflow of visceral nerves, the one passing out in those upper rami viscerales directed upward to form the cervical splanchnics; the other in those lower rami viscerales which pass downward to form the abdominal splanchnics. In both cases they leave the central nervous system among the fine medullated fibres of the anterior roots, the special anterior roots which contain the dilator fibres of the pupil being, according to Budge, the second, third, and fourth thoracic—according to my own observations in the dog, more especially the second thoracic; in the frog they pass out in the anterior root of the fourth nerve.
>
> "In both cases they pass over the lateral ganglion (main sympathetic chain) along the corresponding splanchnic nerves to the distal ganglia before they alter their histological characters; the one passing directly to the superior cervical ganglion in the bundle of fine medullated fibres which can be dissected out of the conjoint vago-sympathetic in the neck, the other in the bundle of similar fibres which passes along the abdominal splanchnics into the semilunar ganglia. In both cases, they cannot be traced further as medullated fibres. In the one case they, in all probability, lose their medulla in the distal semilunar ganglion; in the other, with equal probability, in the distal superior cervical ganglion.
>
> "The histological, anatomical, and physiological evidence, all point to the conclusion that in the sphincter muscle of the iris we have yet another example of a muscular stucture supplied by two nerves of opposite character, the one motor, the other inhibitory."

In this manner Gaskell has furthermore shown that the muscular tissues of the visceral and vascular systems are supplied by two sets of nerves, of which the one sets these tissues in activity and causes their contraction; the other inhibits their contractions, and causes their relaxation. The accelerator nerves of the heart, according to Gaskell, belong structurally, as well as anatomically, to the group of vasomotor nerves, and the nerves which retard or stop the heart's action, to the class of inhibitory nerves.

The question, therefore, arises, What analogy do we find in the action of atropine and its congeners, on the heart, and that which these drugs have on other similarly innervated organs? Let us first examine their action on the pupil.

1. *The Pupil.* It is a well-known fact that all the members of the atropine group cause dilatation of the pupil. Dilatation of the pupil, however, according to the latest researches, is brought about by a stimulation of the inhibitory nerves supplying it, paralysis of these nerves being followed by contraction of the pupil. We have, therefore, here an example of atropine stimulating inhibitory nerve-structures as it does in the heart, the analogy appearing to be quite complete. Atropine, how-

ever, is also known to be a vasomotor stimulant when used in very small doses, and stimulation of the vasomotor nerves supplying the pupil would cause its contraction. It is well known that, under conditions hitherto not yet fully determined, atropine sometimes causes transient but slight contraction of the pupil before dilatation comes on. This would be due, according to our interpretation, to too small doses of atropine, and as soon as a sufficient amount of atropine is absorbed, dilatation must supervene; for the vasomotor nerve apparatus, though quickly and intensely stimulated, is rapidly exhausted by too large doses; the inhibitory nerve apparatus, on the other hand, requiring larger doses to set it into full activity. We have here, as in the case of the heart, simply to regulate the dose according to the effect we wish to produce. If the smaller doses of atropine were sufficient to paralyze the inhibitory nerve-apparatus, then contraction of the pupil would have to follow invariably, and the application of larger doses would not change anything in this result. The facts, however, are quite different, as is well known. In the pupil, therefore, we have a very perfect example illustrating the action of atropine on the two kinds of nerve-structures, exactly as this was made out in the case of the heart.

2. *The Intestine.* The best text-books state that atropine, in very small doses, increases the peristaltic movements of the intestine; moderate doses completely arrest these movements, but do not destroy the irritability of the muscular fibres; large doses stop the movements, and also paralyze the involuntary muscular fibres so that they contract either very feebly, or not at all, on direct irritation. In the case of the intestine, we have yet another example of small doses of atropine stimulating vasomotor nerves, and of larger doses stimulating inhibitory nerves.

3. *The Bloodvessels.* In experiments with atropine on the bloodvessels, published by me in this journal for July, 1885, it was clearly shown that atropine causes at first contraction, and then dilatation of these vessels. We have, therefore, here, as elsewhere, evidence of vasomotor stimulation preceding inhibitory stimulation when small doses are used. In the experiment referred to, it was, however, also shown that this initial contraction took place only during the first, and, at most, the second observations, but not the subsequent ones, apparently indicating that the vasomotor nerves lost their excitability long before the inhibitory nerves did.

The evidence in favor of the uniformity of the action of atropine on these different organs might be still further increased, but the examples cited above are deemed quite sufficient to prove our point. Atropine has long been a favorite remedy of clinicians in all painful spasms of involuntary muscles, such as lead colic, simple colic, asthma, the spasms set up by renal and biliary calculi, painful spasmodic contraction of the circular muscular fibres of the neck of the womb in parturition, etc. Clinical evidence, therefore, is not lacking in proof of the fact that atropine and its allies cause the relaxation of involuntary muscular fibres, by their stimulating influence on inhibitory nerves and their ganglia.

From this brief consideration of the more prominent facts brought out by these experiments, the conclusions are as follows, viz.:

1. Atropine, homatropine, hyoscine, hyoscyamine, and daturine are stimulants of the sympathetic nerve apparatus of the heart.

2. The vasomotor portion of this nerve apparatus is affected by comparatively small doses of these drugs, giving rise to either acceleration or augmentation in the heart's action.

3. The inhibitory portion is excited by larger doses only, giving rise to slowing of the heart's action, and, finally, causing diastolic arrest.

4. The muscular substance of the heart is greatly excited by atropine, homatropine, and daturine, and only slightly so by hyoscine and hyoscyamine.

5. The vasomotor nerves and their ganglia are the first to become exhausted, the inhibitory nerves and their ganglia are the next, and the muscular substance is exhausted last of all.

6. The slowing of the heart's action which follows the administration of these drugs in the intact animal, may be sufficiently accounted for by their influence on the inhibitory nerves and ganglia of the heart itself.

7. The acceleration following the administration of certain doses of these drugs cannot be sufficiently accounted for by their action on the accelerator nerves and ganglia within the heart, but is principally due to causes resident outside this organ.

In conclusion, I have to acknowledge my indebtedness to Professor H. Newell Martin for kindly placing at my disposal the well-equipped laboratory under his charge at the Johns Hopkins University, Baltimore, where the experiments on the heart of the dog were made. I also take this opportunity to thank Dr. John C. Hemmeter for valuable assistance rendered me during some of the preliminary work on the dog's heart. The experiments on the heart of the frog and terrapin were performed at the laboratory of the Museum of Hygiene, under the auspices of the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

TYPHOMALARIAL FEVER.

By J. Edward Squire, M.D. Lond., M.R.C.P.,
OF LONDON.

The early use of any new medical term is necessarily somewhat indefinite, especially when those responsible for the name have not at first clearly indicated the condition which it is intended to signify. In America the term typhomalarial fever is widely used, if we may judge from the number of communications on the subject to the medical journals and societies in all parts of the United States and Canada. To the majority of English practitioners, whose experience has been limited to their own country, the name is unfamiliar, and to all it is wanting in accurate definition. Now that we have admitted the term into our nosology, under official sanction, it is well that we should endeavor clearly to understand to what class of cases it should apply. Although it has been used for a quarter of a century, the term typhomalarial fever is not yet so well defined as to bear a universal significance. The London College of Physicians, in its nomenclature of disease, defines it as a *combination of malarial and enteric fevers.*[1] The Section of Medicine at the International Medical Congress held in Philadelphia in 1876, expressed the opinion[2] that "typhomalarial fever is not a special or distinct type of disease, but the term may be conveniently applied to the compound forms of fever which result from the *combined influence of the causes of the malarial fevers and of typhoid fever.*"

A similar though somewhat different view is well stated by Dr. E. G. Russell in a paper on malarial fevers read before the Epidemiological Society of London in 1881.[3] He says:

> "When a distinctly malarial complication accompanies and is bound up with true enteric fever, we have the disease that has been recognized, and described by numerous writers of divers periods and lands, as paludo-enteric or typhomalarial fever."

If any distinguishing term is required for such cases, which undoubtedly exist, I should prefer the term "malarial enteric fever" which I proposed in my paper on "Fever at Suakim."[4] The most correct description would be to put down both diseases, enteric fever and malaria, just as one would enter syphilis and scarlet fever if the two coexisted. But again, Dr. Russell says:

> "Typhomalarial fever may be taken as affording an illustration of the parallelogram of forces; the malarial poison and the typhoid poison being the two forces acting on a point—the patient—and being represented in magnitude and direction by the two sides of the parallelogram, each produces its full effect in its own proper direction; the resultant being represented in magnitude and direction by the diagonal through this point—*i. e.*, by typhomalarial fever."[5]

Other observers consider typhomalaria to be, not the resultant between two causes, but describe it as enteric fever *modified* or even *induced*, by *malaria*. The chief exponents of this view are Sir Joseph Fayrer and M. Léon Colin. The former writes:

> "I believe that in India enteric lesions are apt to come on in the course of miasmatic fever, and that in this condition they not only resemble but *become*

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[1] The Nomenclature of Disease. Second edition. London, 1885.

[2] Transactions Int. Med. Congress, Philadelphia, 1876, p. xxxviii.

[3] Transactions Epidemiological Society, vol. iv., part iv., p. 559.

[4] Transactions Med.-Chir. Society, 1885-86, vol. lxix. p. 247.

[5] Transactions Epidemiological Society, vol. iv., part iv , p. 559.

identical with those of specific enteric fever, which is caused in India as in England."[1] Or again, "I am, and have long been of opinion that a form of fever exactly like European typhoid, except in its etiology, exists in India and other hot and malarious countries, and that it is due to climatic causes, not to filth or specific causes such as give rise to it in England."[2]

M. Léon Colin[3] also holds that these fevers result from a transformation of paludal into typhoid fever; or, in other words, of malarial into enteric fever. Barker[4] speaks of typhoid fever being produced by "malaria," but he uses the latter term in the wide sense of "infected air," not paludal miasmata only. Inspector General Maclean, Professor of Military Medicine at Netley, in his report on the enteric fever cases sent to Netley from Egypt in 1882, says:

> "Medical officers, who, like the writer, have studied the disease in India, recognize two types; the first, seen in young soldiers who have been but a short time in the country, is, in all its main features, undistinguishable from enteric fever as seen in Europe. In the other, observed in the persons of those longer resident in India, a *malarial complication*, the outcome of that poison, and the changes wrought by it in the solids and fluids of the body, give a distinctly remittent character to the disease, and the lesions in fatal cases, revealed post-mortem, point unequivocally to the work of two factors, the enteric plus the malarial poison."[5]

Surgeon-Major R. W. Jackson, in writing on enteric fever and its modification by malaria in Southeastern Africa, dissents from the hybrid view of the disease. He writes:

> "From what I have seen of the disease termed typhomalaria, I am inclined to believe that the two elements do not intimately mingle in the course of the disease; the malarial appears to be more or less *parasitical* in many cases, with a decided tendency to seize on a subject debilitated by any cause."[6]

Fleet Surgeon Norbury, C.B.R.N.,[7] says, "The so-called typhomalarial fever is, in my opinion, simply enteric fever, and nothing else;" though, as he says, the symptoms may be modified by malaria. These both describe what I would term "malarial fever."

The view to which I myself incline is also propounded and upheld by others whose observation of the disease is more extended than my own; sometimes set forth in published opinions, sometimes borne out by reports of cases or pathological examinations. According to this view, typhomalarial fever is not a subdivision of enteric fever, but a form of malarial fever. This opinion was held by the Commission formed for the purpose of a special inquiry into the disease during the War of the Rebellion, who reported that the camp fever then so prevalent was "bilious remittent fever, which, not having been controlled in the primary stage, had assumed that adynamic type which is present in enteric fever."[1]

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[1] Climate and Fevers of India: Croonian Lectures, 1882, p. 227.

[2] Trans. Epid. Soc., vol. iv., part iii., p. 269.

[3] De la Fièvre Typhoide Palustre: Archives Générales, 1878, part 1, p. 276.

[4] On Malaria and Miasmata: The Fothergillian Prize Essay for 1859. By T. H. Barker, London, 1863, p. iii.

[5] Army Medical Reports, vol. xxiii., 1881.

[6] Dublin Journal of Medical Sciences, January, 1881, p. 17.

[7] Medical and Surgical Notes on South African Warfare. Transactions International Medical Congress, London, 1881, vol. ii. p. 513.

This I should be inclined to adopt as my definition of typhomalarial fever, merely substituting "malarial" for "bilious remittent," and not venturing to specify any cause for the assumption of the typhoid symptoms. My definition would then run as follows: *Typhomalarial fever is a malarial fever which has assumed that adynamic type which is present in enteric fever.* Several of our army medical officers appear to favor this view.

There still remain those, like Virchow,[2] Welch,[3] and others, who would cut the Gordian knot by agreeing with Brig.-Surgeon J. A. Marston, that "there seems to be no satisfactory evidence for including a typhomalarial fever as a distinct morbid entity in our nosology."[4] I agree with these in so far as they hold that typho-malaria is not a specific disease or distinct morbid entity; but I hold that there is sufficient justification for retaining the term in our nosology, provided we understand clearly what we intend should be its signification.

Considering, then, typho-malarial fever as a manifestation of the malarial poison, in which continued fever is accompanied by intestinal symptoms—mainly diarrhœa—and which tends to assume an adynamic or typhoid condition, I proceed to give a sketch of the disease, tracing shortly its history, or rather a history of its recognition, and then describing its symptoms and pathology. Finally, I will endeavor to give its points of difference from enteric fever, so as to help us to arrive at a diagnosis in doubtful cases.

HISTORY.—Where history reaches back to the first record of war we have mention of disease breaking out in the camps; and the attendance of disease on armies in the field has recurred with fearful regularity in all campaigns. As records became more exact (or the preservation of them more successful), descriptions of the prevailing camp-fevers have come down to us with the history of the wars. And looking through those military medical annals, we find that the ancients had to fight against the same disease as we do now, in the field and in the camp, in addition to the "filth diseases" which we now in a great measure prevent. To say that the fever of which I am speaking existed long before it was described so as to be recognizable by us, and was described long before it was named, is only repeating a truism which will hold for almost every disease. In the wars of the middle ages, armies in Italy, Hungary, and along the shores of the Danube suffered terribly from fevers, chiefly typhus and enteric, among which cases occurred very nearly resembling what we now call typhomalarial. To come nearer to our own times, in 1760 Göttingen was visited by an epidemic, described by Röderer and Wagler[1] as *morbus mucosus*, which was a continued fever with diarrhœa and typhoid symptoms, and with pathological signs of intestinal catarrh. Then we have the records of the terrible Walcheren fever in 1809, which spread so rapidly among the British troops that in a month after landing there were only 23,000 infantry and 2000 cavalry fit to take the field, out of a force of nearly 40,000 men: the number in hospital was then nearly 3000, increased in another fortnight to 7000, and in ten days more to nearly 11,000.[2] This was recognized at the time as a malarial fever, and the symptoms as described by Davis and others in many cases resemble typhoid. Similar fevers are described by Pringle,[3] as occurring in our troops in the low countries half a century earlier.

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[1] Woodward: Transactions International Medical Congress, Philadelphia, 1876, p. 312.

[2] Kriegstyphus und Ruhr., Virchow's Archiv, Bd. lii. (1871), 1–42.

[3] "Enteric Fever." Alexander Prize Essay, 1883.

[4] Army Medical Reports, 1880, vol. xxii. p. 326.

After the close of the Peninsular War there was no very protracted campaign in malarious countries until the great civil war in America (1862) fifty years later. During this struggle, which lasted four years, large bodies of men were encamped in low-lying districts in the valleys of the Mississippi, the Ohio, the Potomac, and the Chickahominy rivers, where malaria abounds. A complete and well organized medical service made it possible to collect reports from the various divisions of the army and afterward to compile a medical history of the war, which is a storehouse of information for all who wish to study the diseases incidental to campaigning, or to perfect the hygiene of armies. It is, therefore, to the history of the American war that we are indebted for a clearer description of the disease of which I am speaking, and it was during this war also that the term typhomalarial fever was first used. Many of the surgeons who had known enteric fever at home, found that the prevailing camp fever, though resembling typhoid—often so closely that they had no hesitation in diagnosticating it – had yet in many cases differences so marked as to call for special reports. A commission was appointed to investigate the matter, and on the drawing up of statistical forms for returns of diseases in the army, Dr. Woodward, then Assistant Surgeon in the United States Army, proposed the term typhomalarial fever—the disease being considered by him to be a hybrid between enteric and malarial fever. The first official recognition of the term is in the United States Army Statistical Returns for 1862.

But the disease is not confined to armies in the field, and had been recognized before this time. Lancisci,[4] had noticed it in the Roman marshes in the 17th century, and in America Drake[1] had described it and called it "remitto typhus" twelve years before Woodward named it. English observers in India and elsewhere had described many cases of it as malarial fevers or bilious remittent; and the French had seen it in Algeria. In late years our Army Medical Reports contain many descriptions of the disease and opinions as to its nature.

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[1] De morbo mucoso. Göttingen, 1762.

[2] Davis: On Walcheren Fever, 1810. Introduction.

[3] Observations on the Diseases of the Army, 1774.

[4] De Noxiis Paludum Effluviis. Geneva, 1718.

SYNONYMS.—The disease under consideration is described under many names; and various terms are used by different writers as synonymous with typhomalarial fever. I have mentioned Drake's remitto-typhus, or secondary typhus fever, as he also calls it. Then we meet with paludal-typhoid, paludo-enteric, miasmatic typhoid fever, fæco-malarial fever, bilious remittent, gastric remittent, adynamic remittent, typhoid remittent, and autumnal fever, all of which are now in use; and mucous or pituitous fever (Copeland), *typhus intermittens subintrans and febris intermittens typhosa* (Hermann Schmidt), which are obsolete. From a most valuable report[2] by Surg.-Major Veale on the Fevers from the Mediterranean, treated at Netley in 1879, I get the following: Malta fever, rock (or Gibraltar) fever, Mediterranean fever, and his own suggestion, viz., complex, or complicated fever (*febris complicata*). Many cases are also included under the comprehensive term "simple continued fever."

In giving the synonyms, I only mention terms used when the observer seems to have recognized the disease as that we are calling typhomalarial fever. The other names under which cases have been returned would seem, according to Dr. Veale, to range from enteric fever and rheumatism, to phthisis or chronic pneumonia.

ETIOLOGY.—If I say that wherever malaria is found, there typhomalaria may also occur, I need go no further in describing the climatic and telluric conditions which favor its development, for that would carry me far beyond the scope of this paper. It has been described as occurring in all four continents, and with a wide distribution in each. It is not confined to tropical or subtropical countries, though perhaps more frequent in such climates: it is not uncommon on the shores of the Mediterranean,[3] and cases of typhomalaria have been described (by Dr. Handfield Jones[4] and others) as occurring in England. Until recently, no other fevers were recognized in the Romney marshes except those due to malaria.[5]

In the tropics it would seem that the season at which it is most prevalent is the setting in of the rains (Fayrer and Don), and in more temperate climates, as would naturally be expected, it occurs at the season when both malarial and enteric fevers are most prevalent, viz., in the autumn. With regard to individual predisposition, youth, fresh arrival in a malarious district, and any cause that tends to debilitate the individual, or to depress the spirits, seem to lay persons open to an attack. Over-crowding, or the collection of a large number of persons together, sanitary defects, foul smells, bad water, bad food, hard or harassing duties, are all mentioned by different writers. Thus, campaigning in a malarious country brings all the predisposing causes into force. Standing camps, or prolonged occupation of camping grounds where filth, decomposition, and malarial emanations exist in a subtropical or tropical heat, are most favorable to its development.[1] Some writers suggest that the presence of enteric fever is a predisposing cause; perhaps, rather, it is a cause for the prominence of intestinal symptoms. Certainly the two diseases frequently occur side by side, as is clearly seen in the reports of the American war, in those of our Zulu war, and also at Suakim last year. M. Boudin,[2] the French military surgeon, considered, from his experience, that malaria "excludes, and is antagonistic to" enteric fever, but I suppose he would find few supporters at the present day. The poison being essentially that which produces intermittents and remittents, the mode of their introduction into the system is probably identical.

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[1] The Principal Diseases of the Interior Valley of North America. Cincinnati, 1850.

[2] A. M. D. Reports, 1879, vol. xxi. p. 271.

[3] I believe, as was remarked at the time (Lancet, 1886, vol. i. p. 567), that it is to this cause that we must attribute the loss of a distinguished member of our profession last year, I mean Mr. Cooper Foster.

[4] Medical Times and Gazette, June 27, 1885.

[5] Hilton Fagge: Practice of Medicine, vol. i. p. 283.

Typhomalaria is not transmissible from person to person (Harley),[3] and in this differs from enteric fever.

Having gained a hold upon the individual the poison may lie dormant for a considerable time, and this appears to be one of the marked characteristics of malarial diseases. This was observed in many cases among our troops after the Egyptian campaign in 1882, and also after the Soudan expedition of 1885; on both of which occasions men were constantly admitted to hospital for fever resembling closely enteric (and often correctly so diagnosticated) for some weeks, or even months, after arrival in England; and both among the troops at Aldershot and in Cyprus in 1882,[4] and in the brigade of Guards in 1885, the cases, almost without exception, occurred among those who had returned from the seat of war. In 1882 it is recorded that the brigade of Guards left Alexandria at the end of October and beginning of November (from October 30th to November 7th), and cases of fever continued to be admitted to hospital for nearly nine weeks after that date; and the remark, "that the disease was of Egyptian origin, and was not due to infection from one to another in this country," seems highly probable, because the spread of it was confined to those who had been in Egypt.[5]

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[1] Norbury, Trans. Int. Med Congress, London, 1881, vol. ii. p. 513.

[2] Traité des Fièvres Intermittentes, remittentes et continues de pays chaudes et des contrées marécageuses. Paris, 1842.

[3] Reynolds's System of Medicine. Art. Enteric Fever. 1st ed., 1886, vol. i. p. 610.

[4] A. M. D. Reports, vol. xxiv., 1882.

[5] A. M. D. Reports, 1882, vol. xxiv. p. 117.

SYMPTOMS.—The onset is often gradual, sometimes sudden, and the cases may at first show no differences from other results of malarial poisoning.

Certain premonitory symptoms are mentioned by various observers, among which tonsillitis is spoken of by more than one. Sir Anthony Home, speaking of an outbreak of fever at Sitapur, in Bengal, says, "Nothing is more frequent than the connection in point of time between a preceding tonsillitis and a following enteric fever illness."[1] I suspect that typhomalaria would be a better term to describe this outbreak, and I am unable to find any mention of a preceding tonsillitis in the articles on enteric fever in any of the various text-books. Surgeon-General Woolfreyes, in describing the fever which occurred among the troops in Natal during the Zulu war, and which he recognized as typhomalarial, says, "It, as a rule, commences with sore throat, a peculiarity."[2] So, too, the fever designated generally as "typhomalarial," so prevalent at the several outposts during the Galeaka-Gaika campaign in the Cape Colony, nearly always commenced with sore throat.[3] Dr. Don speaks of tonsillitis preceding the continuous enteric fever of Bermuda.[4] I noticed several cases of tonsillitis among the troops at Suakim while fever was prevalent, but was not then aware of their possible significance. I certainly met with it in some men who were never admitted to hospital then or later.[5] The onset then is gradual, with indefinite malaise, headache, loss of appetite, and possibly chills, and pains or aches in various parts of the body. Assistant Surgeon Billings, U. S. Army, says, "The malarial element is always prominent at the commencement, the typhoid element making its appearance on the fifth or sixth day, and gradually becoming more prominent."[6] Sickness is a distinctive and almost constant symptom, the vomited matters often being greenish.

Diarrhœa is generally present, but where camp-diarrhœa is prevalent may cause no comment.

As the disease progresses the diarrhœa may be more frequent. The stools vary: they may be greenish, as is common in remittents; watery and brown; or sometimes resembling the "pea soup" stools of enteric fever.

Now and then, when diarrhœa is the rule, a solid and apparently healthy motion may be passed in the middle of the illness. There may be constipation throughout.

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[1] A. M. D. Reports, 1882, vol. xxiv. p. 81.

[2] Fayrer: Op. cit., p. 194.

[3] A. M. D. Reports, 1879, vol. xxi., p. 294.

[4] Ibid., vol. xi., 1869. Appendix. No. xi. p. 385.

[5] I may mention that since my return from Suakim I have had several attacks of "Soudan Fever,"—clearly malarial; and that on the last few occasions I have noticed that sore throat precedes and accompanies the fever.

[6] Report on the Treatment in the Army of the Potomac during 1864.

The temperature is raised from the commencement of illness; at first, it may be, with complete remissions, afterward becoming continued, sometimes very high, and often irregular. The pulse is small, feeble, often dicrotic, and rapid, and shows no relation to the temperature.

A symptom is noticed in the reports of the Zulu war which reminds us forcibly of the description of the mucous fever in Göttingen. This is a "hyperæmic condition of the entire alimentary tract, indicated by congestion of the throat and fauces, the excessive secretion of mucus, the copious mucous diarrhœa, accompanied by tenesmus, and followed after straining by a little pure blood."[1]

Jaundice has been noticed in several instances, and hepatic congestion is frequently met with in the early stages. The abdomen is distended; and there may be pain and gurgling on pressure in the right iliac fossa, a frequent sign in diarrhœa. The spleen is enlarged. The tongue in severe cases is furred and swollen; later it may become dry, brown, and cracked.

In severe and prolonged cases we find subsultus tendinum, sordes on the teeth, low muttering delirium, and continual vomiting. Death results from exhaustion. It is stated that rose spots are found on the abdomen as in enteric fever, but I should almost consider the spots to be pathognomonic of the specific disease.

In cases which end in recovery, the duration of the disease is very variable. During an epidemic many men come into hospital with all the signs of a severe attack, and after a few days' illness are practically well, though careful observation might show evening fever for some time after they have left the hospital. Severe cases have a longer course than enteric fever, and linger on for seventy days or more (Maclean, Lane, Notter). In one of my cases the patient was under treatment for thirteen weeks, or ninety days. For some time after all marked illness has disappeared the temperature may go on oscillating from 98° to 102° or 103° F. at night, the patient meanwhile having a good appetite and feeling well.[2] This prolonged course is very characteristic, and quite different from the relapses in enteric fever; sometimes diarrhœa continues during the whole time. In some cases a rheumatic affection of the fibrous tissues round the joints and other parts[3] may persist for weeks or months; in others, anæmia is the only remaining sign of illness. Tenderness over the hepatic region may be noticed throughout convalescence.

Complications.—Of these the chief are pulmonary congestion, bronchitis or pneumonia, hemorrhages from the bowels, or other mucous surfaces, as epistaxis. With these hemorrhages I may mention the purpuric blotches on the skin noticed in two of my fatal cases at Suakim, and reported in my paper on the fever there.[1]

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[1] A. M. D. Reports, 1879, vol. xxi. p. 293.

[2] Ibid., p. 266.

[3] Ibid., p. 266.

Purpura has been noticed as a complication of Gibraltar fever,[2] which sometimes at least takes the typhomalarial form. In the Zulu war, also, we are told that in some of the cases of fever there was "a cutaneous redness larger than a man's hand, which appeared in various localities, but especially on the side of the thorax, and outer side of the upper arm." This did not disappear on pressure, and on incision post mortem small blood coagula were found in the centre. It was always a fatal sign.[3] Profuse perspiration with sudamina may occur. Rheumatism, sometimes attended with effusion into joints, has been observed,[4] and has long been recognized as a usual sequela of Malta fever or Mediterranean remittent.[5]

PATHOLOGY.—A clear understanding of the pathological changes brought about by any morbid process is essential, if we wish to perfect our knowledge as to the symptoms, course, or general history of a disease. For it is by pathological examination that we are enabled to check or verify our diagnosis, and so know positively with what disease we have to deal—a point which may remain uncertain without such means of proof. I am about to venture a statement which will meet with some opposition, if I may judge by the opinions expressed by most of those who have written on typhomalarial fever—it is this. The pathological changes found after death from typhomalaria differ from those characteristic of enteric fever, and serve to distinguish the two diseases from one another: they are, in fact, the *pathological signs of malarial fevers.* Many writers state that necropsies in cases of typhomalarial fever show the peculiar ulceration of Peyer's patches which is considered characteristic of enteric fever. I believe that when the characteristic Peyerian ulceration is found we may take it that the patient has had true enteric fever, which may have been complicated with malaria no doubt, but this does not constitute typhomalarial fever.

The two diseases, as I have already mentioned, often exist side by side in the same camp, and may be treated in the same ward; the symptoms during life are much alike, and doubt may exist as to the diagnosis throughout the whole illness. What wonder then if a case diagnosticated as typhomalarial fever convict us of error in diagnosis by revealing Peyerian ulceration at the post mortem, or if a careful search in a case supposed to be enteric fever should disappoint us by the absence of enteric ulcers. A most instructive account of a simultaneous outbreak of enteric fever and of typhomalarial fever in two regiments in adjoining camps, where the two diseases could be studied side by side, will be found in the Appendix to the *Army Medical Report* for 1879. This report teems with important facts which help us to study the differences between the two diseases. In this outbreak it was at first considered that the two fevers might be one and the same disease, till fatal cases demonstrated that the two diseases were perfectly distinct: for, whereas, the necropsies in one camp showed "the local lesions of the intestinal glands which are the invariable concomitants and anatomical expression" of enteric fever, in a fatal case in the other camp the intestine was found to be perfectly healthy.[1] I do not wish to be understood to deny that ulcers may be found in the small intestine in typhomalaria: on the contrary, I imagine they may be frequently present, but they do not select Peyer's patches or the solitary glands, or confine themselves to these, as enteric fever ulcers do. The presence of ulcers in the small intestine in patients dying of malarial fevers has been observed over and over again. Annesley[2] and Twyning[3] both mention superficial ulceration of the mucous membrane of the small intestine in protracted cases of the "congestive fever" of the cold season in India. Ulcers, sometimes possibly those of enteric fever, but sometimes quite different, were noticed in the Walcheren fever (Davis). Dr. Wall, of Calcutta, describes irregular ulceration, by no means selecting the site of Peyer's patches, and often encircling the intestine.[4] Surgeon-Major Edge, in reporting on the camp fevers during the Zulu war, writes: "Post-mortem examination revealed the great differences between the diseases. In remittent fevers the ulceration was not in Peyer's patches or certainly not confined to them, nor were Peyer's patches or the solitary glands traceable in the great inflammation and thickening of the lower part of the ilium."[5] Others are unable to distinguish between the ulcers in some malarial fevers and those of enteric fever, believing the former to develop into true enteric. Dr. Morehead goes further and says, "Disease of Peyer's glands . . . is not peculiar to typhoid fever only, for it occurs in cholera, in protracted diarrhœa, and in acute muco-enteritis, or as an occasional complication of remittent fever, and is a frequent one of phthisis pulmonalis."[7]

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[1] Trans. Med.-Chir. Society, 1885–86, vol. lxix. p. 247.

[2] A. M. D. Reports, 1881, vol. xxii. p. 33.

[3] Trans. Int. Med. Congress, London, 1881, vol. ii. p. 513.

[4] A. M. D. Reports, 1879, vol. xxi. p. 266.

[5] Ibid., 1861, vol. iii. p. 507.

Dr. Jules Guérin,[7] of Paris, considers that the organic lesions found in the intestine in enteric fever are the effects of virulent and ulcerative action of typhoid matters on the parts—*i. e.*, a local irritative action, not the result of the specific poison. If this were so, other irritative contents of the bowels might be expected to produce exactly the same results.

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[1] A. M. D. Reports, 1879, vol. xxi. p. 253.

[2] Diseases of India.

[3] Diseases of Bengal, second edition, 1835.

[4] Fayrer, op. cit., p. 175.

[5] A M. D. Reports, 1879, vol. xxi. p. 306.

[6] Researches on Diseases in India, p. 160.

[7] Transactions of the International Medical Congress, London, 1881, vol. ii. p. 91.

To enumerate the chief pathological appearances found in cases of typhomalarial fever: First, as to the alimentary tract. There may be congestion of the throat and pharynx, with excessive amount of secretion; and this may extend throughout the whole length of the alimentary canal. This was found in one of my necropsies at Suakim, where, besides the injection of the mucous coat, submucous ecchymoses were present. Woodward notices this condition. He has collected a number of autopsies in which the illness had strikingly resembled enteric fever, but in which dissection showed no other lesion in the alimentary canal than a smart intestinal catarrh. The characteristic lesions were "Patches of inflammation scattered irregularly throughout both small and large intestines and enlargement of the closed glands, often associated with pigment deposits."[1] Annesley says, "occasionally the mucous surface (of the intestines) is of a brick-red or purplish shade of color, apparently ecchymosed."[2] Twyning also mentions[3] inflammation and ecchymosis of the small intestine without ulceration; and morbid vascularity of the duodenum. In cases of the Walcheren fever, Davis found the intestines of a purplish hue. Surgeon-Major Boulton mentions having seen this in the West Indies.[4] Congestion and ecchymosis in the intestines must, therefore, be considered a frequent pathological sign in typhomalaria; and would appear to be not uncommon in remittent fever. Most observers consider the congestion of the mucous coat to be most marked in the duodenum, and upper part of the jejunum; and some describe the ilium as healthy. I have certainly seen the latter congested and ecchymosed.

In more severe or prolonged cases ulcerations may be found in almost any part of the small or large intestine, though Annesley thinks it is most commonly to be seen in the termination of the ilium; probably here he is confounding it with enteric. They are irregular ulcers, which may be small and agglomerated, or large and far apart, sometimes encircling the intestine, and not selecting the intestinal ductless glands. They are usually superficial, not penetrating beyond the mucous membrane, though they may be deep enough to cause perforation.[5]

The spleen is enlarged, soft, and friable; the liver congested and hard; the gall-bladder sometimes distended with bile. All the above, be it observed, are pathological results of malaria, not of enteric fever poison.

The lungs may show signs of the complications which affect those organs, most commonly being congested at their bases posteriorly.

Purpuric ecchymoses may be seen in the skin.

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[1] Typhomalarial Fever. Transactions of the International Medical Congress, Phila., 1876, p. 331.

[2] Op. cit., vol. ii. p. 457.

[3] Op. cit.

[4] A. M. D. Reports, 1879, vol. xxi. p. 306.

[5] Op. cit.

Diagnosis.—All those who have seen much of malaria have noted how its symptoms frequently simulate those of enteric fever, so closely, in some cases, that a diagnosis is almost impossible. This led Dr. J. Harley[1] to express the opinion that "we unhesitatingly conclude that enteric fever is often a part of intermittent fever, and the converse." The Indian records before the time of Scriven—and even since enteric fever has been recognized in India—show this difficulty clearly. Malaria may cause a continued fever with diarrhœa and intense prostration; and enteric fever, as Murchison pointed out, may show remissions in its temperature chart, or put on the intermittent type at the commencement in malarious countries.[2] When, therefore, we come to deal with a disease intermediate as regards its symptoms between remittents and enteric fever, the difficulty of diagnosis is increased, especially when all three diseases exist side by side. An example of this difficulty occurred on board H. M. S. Alexandra, on the Mediterranean Station in 1879, where there was a case, the diagnosis of which was attended with uncertainty till after its fatal termination, when the post-mortem examination "revealed such enteric disease as could only be attributed to the typhoid poison, viz., ulceration of the solitary glands and of Peyer's patches with perforation of the bowel; yet the symptoms of this case during life differed very slightly from those of others in which these pathological changes were entirely wanting."[3] I shall not attempt to give any points to distinguish typhomalarial fever from malarial fevers (as those who consider it a subdivision of enteric fever would be obliged to do), for I consider it a malarial fever, to which a special interest attaches, from its symptoms simulating enteric fever, though its etiology and pathological result are different.

The real question is, How are we to distinguish it from enteric fever? and that is the main difficulty. We must not forget that enteric fever can be modified by malarial complications—what I propose to call "malarial enteric fever"—and that this increases our difficulty in discriminating between them. The chief modifications in the course of enteric fever produced by malaria are as follows: A prolongation of the incubation period (as was seen after the Egyptian and Soudan campaigns—for in some of the fatal cases among those referred to on page 401, the Peyerian ulcers of enteric fever were found); variations in the temperature curves, such as a wider daily range, marked intermissions or regular remissions, and a lengthening of the febrile condition, or more protracted convalescence. Typical ague attacks have occurred in the course of enteric fever.[4]

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[1] Reynolds's System of Medicine, 1866, vol. i. p. 604.

[2] Bartlett: Fevers of the United States, 1856.

[3] Naval Medical Report, 1879, p. 27.

[4] A. M. D. Reports, 1880, vol. xxii. p. 96.

How then shall we distinguish typhomalarial from enteric fever? The onset in both is similar, though sometimes more sudden in the former.

I should consider that though the absence of rose spots does not negative enteric fever, their presence, if they could be recognized with certainty, would exclude typhomalarial fever. Murchison[1] considers the spots the only sign by which enteric fever can be diagnosticated from remittent fever in some cases. Persistent and uncontrollable bilious vomiting, especially if commencing early in the illness, is in favor of typhomalarial fever, though, of course, vomiting may occur late with extensive ulceration in enteric fever. The greater frequency of vomiting in typhomalarial fever probably depends upon the more frequent implication of the duodenum and higher parts of the alimentary tract in the morbid process. The character of the stools may assist diagnosis if they are greenish or dark colored; but in both diseases they may have the ochre color common in enteric fever evacuations.

When the duodenum and upper parts of the intestine are chiefly affected in typhomalarial fever, the abdominal pain and tenderness will be most marked in the epigastrium, rather than in the right iliac region. Hemorrhage from the bowels occurs in enteric fever, during separation of the sloughs in the intestine, and epistaxis may also occur in the early stage of the illness. In typhomalarial fever hemorrhages may occur at any stage; and from the bowel (which would appear to be a not uncommon occurrence), from the mouth, nose, or urinary organs.

Pyrexia. In the course of the illness the temperature chart will often give a guide to the nature of the disease. The typical temperature chart in enteric fever is well known, and in a simple, uncomplicated case there would be little doubt as to the diagnosis. Speaking generally, the fever in typhomalaria would seem to run up more quickly, and become high earlier in the illness than would be the case in enteric fever. Its course would not be so uniform, and the daily range is greater in the former.

While at Suakim, Surgeon-Major Cotter mentioned to me that he had observed in India that, whereas in enteric fever the highest temperature of the day occurred in the evening, the daily acme of malarial fevers was usually about noon. My few observations led me to believe that this is not a constant occurrence. The delirium of malarial fever is said to come on earlier in the illness than it usually does in enteric fever.

It will be noticed that my points for diagnosis are mainly those recognized as helping to distinguish malarial fevers from enteric. These points of difference are more fully detailed by Sir Joseph Fayrer in his "Croonian Lectures,"[2] by Dr. J. Harley in Reynolds's *System of Medicine*,[3] by Dr. Russell in the *Epidemiological Society's Transactions*,[4] and by Dr.

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[1] Murchison: Continued Fevers, 3d edition, 1884, p. 597.

[2] Op. cit.

[3] Art. Enteric Fever.

[4] Epid. Soc. Trans., vol. 4, part iv.

Lyon in the *Indian Annals of Medical Science*,[1] to whom I would refer those who would pursue this subject.

Prognosis.—The immediate danger to life is probably no less than in enteric fever. Convalescence will generally be very much prolonged; and after-effects, such as follow malarial fevers in general, may be expected.

Treatment.—In the earlier stages, caution will suggest as strict a *liquid diet* as is necessary in enteric fever. When diagnosis has excluded the latter, and symptoms point to an absence of inflammation of the alimentary canal, a return to solid food may be permitted earlier, and with more safety, than in enteric fever.

Whereas in enteric fever aperients are contraindicated, there would seem to be some reason for giving a *mild aperient* in the early stages of typhomalarial fever, with congestion of the duodenal mucous membrane, and, possibly, also of the stomach. *Quinine* is the most important drug, and may be said to form a necessary part of the treatment. In enteric fever it will do no more than reduce the temperature, in typhomalarial fever it may check the disease.

Some would recommend us to observe the effects of quinine as an aid to diagnosis; but diagnosis should lead to treatment, not haphazard drugging suggest a diagnosis.

Stimulants will often be required, and are essential in prolonged and adynamic cases.

A most important aid to cure, when it can be carried out, is to get the patient away from the malarious district as soon as possible. This will sometimes give a chance of recovery in cases which would otherwise be hopeless.

I have tried in this paper to bring together the observations of many who have described what I understand to be typhomalarial fever, and so to draw up a systematic, and, I hope, fairly complete description of the disease.

I must again reiterate my opinion that typhomalarial fever should be considered a malarial disease, and absolutely distinct from enteric fever in its etiology and pathology. Its claim to be distinguished by a special name lies in the fact of its symptoms simulating so closely those of enteric fever.

If the review of the subject here presented does anything to hasten the clearer understanding of what is signified by the term, and of what cases ought to be described as typhomalarial fever, it will have justified the preparation of this paper.

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[1] Typhoid Fever Discriminated from Remittent Fever Indian Annals Med. Sci., No. 28, 1871, p. 241.

WAKING-NUMBNESS:[1]
A HERETOFORE UNDESCRIBED NEUROSIS.

By Andrew H. Smith, M.D.,

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Six years ago the following case came to my notice, and I have had constant opportunity to observe it since:

Case I.—A gentleman, forty-three years of age, in perfect health, and very actively engaged in professional work, experienced every time that he awoke from sleep a sensation of numbness in the ulnar distribution in each hand. The sensation exactly resembled that which results from pressure upon a nerve, and with which we are all so familiar, when, as we say, the foot goes to sleep. But it was soon observed that motion, sensation, and the tactile sense were entirely unaffected, while in the case of pressure upon a nerve, all these functions are suspended. The condition occurred independently of posture and of any other circumstance, save the essential one of waking out of sleep. If the patient dozed a moment in his chair, the peculiar sensation was sure to be present when he awoke.

For some months the numbness or tingling was confined to the little finger and the ulnar side of the ring finger, but gradually it spread over the whole of both hands, then up to the elbows, and finally reached the shoulders, and overspread the upper part of the thorax. Next, the tip of the tongue became affected, and in the course of two or three years the lips were included. Since then there has been no further progress; on the contrary, for the last year and a half the shoulders and chest have been exempt. The period during which the patient is conscious of the sensation does not exceed a minute. He thinks that for some time past it has been absent very frequently, but he has become so accustomed to it that it may pass unobserved, unless more than usually intense.

Quite often a position is assumed during the night in which the ulnar nerve is compressed. The opportunity is then afforded of contrasting the two conditions. In the ulnar distribution there will be paralysis of motion and sensation, and the tactile sense will be lost; while in the rest of the hand these functions will be intact. The feeling of numbness, however, will be uniform throughout the hand.

I have been able to collect three cases of this affection, besides the one described above. One was in my own practice, and the others in the practice of friends, to whom I am indebted for the histories. The second case in my own practice occurred in the person of a type-setter, forty years of age, who came under my observation November 5, 1886.

Case II.—No history of syphilis, rheumatism, or the alcohol habit could be obtained. Was well until five years ago, when, on waking one morning, he found himself partly paralyzed in the right arm and leg.

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[1] A convenient name for this would be *narkophypnia*; *ναρκη*, numbness; *αφυπνόω*, to awake.

There was also some thickness of speech, which, however, soon disappeared. The paresis continued, and two years later was followed by a similar attack affecting the left side and the left half of the face. This attack was accompanied by intense abdominal pain and severe constipation, and was followed by œdema of the right leg. The paresis still continues, being most marked in the right leg. He drags the right toe in walking. He is cachectic and badly nourished, and there is a blue line along the gums. Has had several attacks of lead colic. The patellar reflex is diminished on the left side, and slightly exaggerated on the right. Umbilical reflex normal on the left side, absent on the right. Cremasteric absent on the left side, normal on the right. Plantar reflex exaggerated on the left side. Electro-muscular contractility everywhere normal.

Patient complains of a sensation of numbness or tingling in the fingers of both hands on awaking out of sleep. There is no impairment of motion, and he can appreciate the qualities of the bed-clothes, for example, by the sense of touch, as well as ever. There is no change in the appearance or temperature of the fingers. The sensation is always present on awaking, even if it be only from a short nap in the daytime. It passes off in the course of one or two minutes, without having recourse to rubbing or other means for its removal. Occasionally it is felt on the left side of the face and neck. The patient is an intelligent man, and his statements are very clear and definite.

The next case is furnished by Dr. S. H. Hunt, of Long Branch, N. J., and I will give it in his own words:

Case III.—Miss G. S., æt. twenty-five years, had, in August last, a severe attack of malarial dysentery, which lasted for one week, producing great emaciation and prostration. After a few weeks her recovery seemed complete, and she was able to perform her accustomed household duties. In the last week of November I was called to see her on account of a numbness of the right arm, which occurred only on her waking in the morning. It was referable to the ulnar side of the arm, and she complained mostly of those parts which received the terminal branches of the ulnar nerve. She stated that she had noticed it for the previous two weeks. There was no loss of motion or sensation, or of the tactile sense. It seemed to commence in the extremities of the fingers, and extended up the arm. She commenced rubbing her hand and forearm on waking, and this condition often lasted an hour or two. Knowing her previous history, and suspecting it might be attributable to malarial toxæmia, I gave her antiperiodic doses of quinine, twenty grains daily. On the first night she awoke at midnight, and said the sensation occurred at that time, but was very slight. On the repetition of the dose, there was an entire absence of the sensation, which led me to believe I had found the cause of the trouble. Much to my chagrin, there was a recurrence of the numbness on the third morning. Quinine, iron, and strychnine were then given as a tonic, but the sensation was persistent and obstinate for another week. This tonic, with a change of climate and absolute rest, ultimately gave her relief, and the peculiar numbness disappeared with her general improvement. Up to this date, January, 1887, there has been no return of it. The arm "being asleep," from the position in which it is placed, is a frequent occurrence, but this sensation at waking, and lasting so long, has led me to inquire what is the *cause* or condition that gives rise to it.

The next case occurred in the practice of Dr. S. H. Burchard, of New York, and is furnished to me by his associate, Dr. H. A. Mandeville:

CASE IV.—Mr. B. W. B., fifty-three years of age. Patient is now suffering from partial paraplegia dependent upon chronic myelitis. About six weeks ago patient began to complain of sensation of general numbness upon first awakening in the morning, which lasts until after free muscular movements of the body, when it gradually passes off; if the patient falls asleep again he experiences the same sensations, which are relieved in the same manner. During these attacks he has absolutely no loss of power; his common sensation, as well as his tactile sense, is perfectly normal. Urine contains a large quantity of oxalate of lime, and is highly acid, otherwise normal.

The patient has been in the habit of sleeping with his head very low, and, thinking that the numbness might be due to an impeded cerebral circulation, it was suggested that he sleep with his head higher. This was accordingly done, with relief to the more prominent symptoms in a few days, but he still complains of the numbness on first awakening.

From a study of these cases it is apparent that the numbness is something added to the normal condition, while nothing is subtracted from it. It is a purely subjective condition. There is no paralysis of motion or sensation, the tactile sense is unimpaired, there is no change in the temperature of the affected part, the surface is not blanched or mottled, there is no tenderness on pressure. These characteristics separate this condition widely from those known under the names of night-palsy, local asphyxia, digiti mortui, Raynaud's disease, erythromelalgia, and from the various paræsthesias and acroneuroses heretofore described.

Doubtless the conditions upon which the numbness depends are present during sleep, but the sensation is not sufficiently strong to arouse the sleeper, and he first becomes conscious of it when awakened by some other cause.

The cause of this condition is probably central, since the effect is usually symmetrical. It would seem to be connected with the lowering of the circulation which takes place during sleep, and to disappear when the circulation returns to the waking condition, whether the return be spontaneous, or the result of rubbing, etc. As to the latter, it is doubtful whether it has any other effect than that upon the general circulation which the muscular exertion would necessarily produce.

As for treatment, in the only case in which the condition existed by itself, and independently of more serious conditions, ergot, digitalis, strychnia, and aconite were tried at different times, but without result. The inconvenience produced by the affection was so slight, that no treatment was carried out efficiently, so that even these negative results were of no value. In each of the other cases there was a diseased condition present, to which the numbness was subordinate, and which afforded the indications for treatment. In proportion as the treatment of the underlying condition was successful the numbness disappeared. If it be true that the cause is central, no local treatment is likely be of service.

A CONTRIBUTION TO THE MANAGEMENT OF GENERAL ATROPHY (SCLEROSIS?) OF THE CONDUCTING APPARATUS OF THE EAR.

By S. O. Richey, M.D.,
OF WASHINGTON, D. C.

When discussing the nature of this affection in the *Archives of Otol.*, vol. xv., No. 1, 1886, attention was called to the fact that local stimulation, applied immediately to the diseased tissues, promises the most efficient results yet obtained, but no attempt was made to elaborate the details of management, or to describe the means of producing the desired effect in this peculiar region, difficult of approach, sensitive to and resentful of the presence of instruments and medicaments to which it is unaccustomed, and located so near the centre of the senses that many unexpected manifestations of their displeasure occur, which, though merely functional and temporary, are very disagreeable while they last. The necessity of repeating the manipulations and applications for a long time divests the procedure of any sentimental impressions it might otherwise leave. In the ratio of the rapidity of the increase of the impairment of hearing may we find an indication as to the length of time requisite for its proper treatment; for, the slower its progress, the more firmly will the disease changes have established themselves, and, therefore, the more difficult, and the longer the time necessary to remove them.

Empirically repeated incisions of the membrana tympani may, by the contraction of their cicatrices, restore the membrane to a *shape* more nearly normal, but what will be the ultimate effect of this scar tissue? May it not be worse than the condition it was devised to relieve?

No good reason, based upon pathology, is given for such interference, and I am convinced no thinking man will advise such a course, without a better reason than any yet advanced in its favor. An air-douche to the middle ear, unaccompanied by any other agent, is questionable therapeusis: it is a mechanical shock to a sick organ to be resented sooner or later; generally, at such a time that no connection can be traced.

Depressions of the membrana tympani, alteration in its translucency, thickening of its tissues, and the appearance suggesting adhesions are probably due to changes in the mucous layer of the membrane and that lining the cavity.

Division of the tensor muscle, the use of Siegle's otoscope, forcible inflation, etc., have been resorted to for the purpose of relieving these features, often with the hearing improved to some degree after each, only to relapse into a worse condition with less prospect of improvement than before.

More frequently a flapping drum-head results, with pain and dizziness when blowing the nose, if there is not stenosis of the Eustachian tubes. The writer has often seen this condition following the too free use of the Politzer or the Valsalvan method of inflation, and generally in the ear not intended to be treated. With gentleness and care this misfortune may be corrected, but forms a long and tedious introduction to the necessary treatment of the original affection, when it happens to an ear already diseased, though it could be avoided by prudence in the beginning.

Too much stress is laid upon the fact that a drum-membrane is depressed, except as an evidence of the affection behind it, and producing it, the improvement of which establishes the proper position and condition of the membrana tympani in a perfectly natural way, by a removal of the cause: just as a pannus may often be cured by treating the conjunctivitis.

The morbid process in the cases under discussion does not, to our knowledge, cause death, and hence our opportunities are limited for completing their history by an autopsy, after close observation during life; and in this way only can the question be definitely settled; but it is not my impression that depression of the membrana tympani is so frequently due to retraction of the tensor muscle, or to adhesions to the inner wall of the cavity, as has been supposed, but, reasoning clinically, to shrinking of the mucous layer of the drum-head from atrophy, which slowly involves the whole membrane. The membrana tympani has, moreover, been seen to change in this feature, and in translucency, with the improvement from dryness and atrophy in the middle ear cavity, and that without special *force* from within. With the change in the mucous membrane toward health is associated a tendency of the membrana tympani to resume its natural and original position, and the less the solution of continuity of tissue has been in the membrana tympani, the better it should perform its function.

How much are we indebted to an atrophied condition of the conducting ear, for that variety of tinnitus, due, probably, to anæmia, which begins before there is any other prominent symptom of disease; which increases slowly, is very intractable, and often is not relieved until long after the hearing is improved? When this tinnitus is dependent upon disease of the naso-pharyngeal space, it is variable; that is, it is heard sometimes in one ear; again, in the other; and, at another time, in both. It is relieved by restoring in the nasopharynx the natural relations for resonance.

Is persistent tinnitus in a given ear, when cerebral, circulatory, or nasopharyngeal causes can be excluded, not due to a disturbance in the character of the cavity; its moisture, its tension, form, size, etc.? Does not a modification of this alteration, by a topical application of therapeutic agents, offer us the best prospect of success?

The anatomical peculiarities of the tympanic cavity, its impatience of artificial control, and its resentment of the presence of foreign substances, limit, for the purpose of stimulation, the means at our command.

No *fluid* having this therapeutic value can with safety be carried beyond the isthmus of the Eustachian tubes, the danger being that, reaching the cavity, it will settle in the depressions, and by undue action there cause inflammation. We are thus confined to *vapors* for this purpose, because they diffuse themselves throughout the whole cavity without partiality and affect the entire lining membrane, producing no more influence in one locality than in another; they, at least, do this better than any other form of medication.

Chloroform or ether vapors have not been very efficient in my hands; for, while they cause considerable hyperæmia, this as readily passes off, unless so much vapor is used as to make the danger of acute inflammation so imminent that I have not felt justified in persisting with it. By very frequent application in moderate quantity, it might serve the desired purpose with diminished risk, but the object to be obtained is an almost *constant fixed action, an approximately continued influence*, and it is not easy to see how, with this agent, it can be accomplished. The mere odor of either chloroform or ether will cause nausea at once in some individuals, and generally does so with all, sooner or later; another reason for abandoning it.

My intention was to try a vapor of *chloroform and turpentine*, but the objections to chloroform were so pronounced, and the dread that the vesicular eruption and obstinate ulceration, which turpentine sometimes produces when applied to the skin, might be repeated in the mucous membrane, has so far deterred me from the experiment, which will probably be left to some one bolder.

Ammonia might be serviceable if it could be confined to the middle ear cavity, but its extreme volatility diffuses it through the pharynx and nares in a most uncomfortable way.

In circumstances of extreme difficulty we are apt to be content with what *has* answered the purpose in our hands, and my reliance has been almost entirely upon the vapor of iodine, with good, though not with uniformly satisfactory results.

The method adopted early in my practice is that which I first saw used by S. J. Jones,[1] of Chicago, which is a modification and combination by him of several other methods. It differs from the Politzer methods in the substitution of the local anæsthesia bulb for the large bag, and *the use of the catheter*, which should be of malleable silver, as this may be readily adjusted in shape to pass through the nostril and reach the Eustachian orifice, anatomical variations being frequent on even the two sides of the same individual. In addition, being made of metal, it may be sterilized by dipping it in alcohol, and burning it out.

By these means we may be satisfied that the vapor reaches the objective middle ear cavity *first*, though the reflux reaches the air passages, from which it is not always desirable to exclude it; and, when it is, the severity of the application may be limited. The *smaller* bulb may be easily and firmly grasped in the hand, is readily compressible, and a measure of the obstruction of the tube, or of the pressure to which the membrana tympani is being subjected, may be ascertained by the resistance of the bulb to the hand. The light and flexible tubing, between the Buttle's inhaler, and the hand-bulb, removes the risk of dragging upon the catheter when compressing the bulb; or of bending or breaking the catheter, as some of the books warn us, in describing the use of the Politzer bag with the catheter. *Hard-rubber* catheters are brittle, and require the aid of heat if a change in shape is desired, and for this reason are cumbersome. Besides, they are unclean, because they cannot be as easily and efficiently purified as can the silver instruments, as above suggested. Some silver catheters are rudely and inartistically made, and can be handled with no more facility than those of rubber, but the delicacy and ease of manipulation which can be acquired with the silver instrument, *properly* made, and the complete security against the danger from inoculation when it has been "purified by fire," add greatly to the comfort of the surgeon, and the comfort and safety of the patient.

The mechanical force arising from the quick *shocks* of air propelled by the hand-bulb has seemed to me as objectionable, only in a much less degree, as those inflicted by the large Politzer bag. The pressure in the middle ear cavity is temporarily very great, and a more steady and less forcible pressure must commend itself to our judgment. This I have secured by means of condensed air, with the aid of the air-pump and receiver ordinarily used by laryngologists in spraying the pharynx and the contiguous regions. With the "cut-off" which accompanies this instrument, we may have absolute control of the air-pressure in the middle ear, and if at any time the sharp impulse of air is desired, or deemed advisable, it is easily secured by this means.

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[1] Trans. of the International Medical Congress, Philadelphia, 1876. "Modifications of the Methods of Treating Chronic Non-suppurative Inflammation of the Eustachian Tube and Middle Ear."

In the cases of so-called "*dry* aural *catarrh*," the Eustachian tubes are usually without obstruction, and a pressure of air sufficient to carry the vaporized medicament into the deep recesses of the ear seems sufficient. In my experience, this can be accomplished with a pressure varying from one-fifth to one atmosphere (three to fifteen pounds). The vapor, during the continued pressure, escapes into the pharynx and nares by the side of the catheter, and the return current meeting the advancing current near the orifice of the catheter produces a slight *rustling* sound, which is perceptible by means of the *auscultation tube*. The impingement of the advancing current of air upon the membrana tympani is also to be distinguished, if it reaches the cavity of the middle ear, by a light *blowing* sound.

It is best to suspend the pressure during inspiration, and to continue it during expiration; in this way avoiding, as much as possible, the extension of the vapor to the trachea, bronchi, and lungs, rendering it less disagreeable, and, with the assistance of the column of air expired, securing a more efficient application to the cavity. Besides, the expiration relieves the pharynx and nasal passages of the presence of the reflux of vapor as it escapes from the Eustachian tubes. A white handkerchief held to the nose has often been observed to be stained by the iodine vapor, which could reach it in no other way.

It has become my practice to *moisten* the sponges only when fitting them into the Buttle's inhaler, for by drying they adapt themselves to its shape better; not afterward, for the *crystals* of iodine evaporate with the air passing over them, as well when the sponges are dry as when they are moist. Constant use of the muscles of the forearm in compressing the hand-bulb is not without its risks to the surgeon, as it may induce morbid growths there; another reason for the use of condensed air.

Finding the hand-pump troublesome and inconvenient, my resort has been a hydraulic automatic air-pump,[1] which, being connected with the aqueduct water, gives a pressure of air equal to the pressure of water in the pipes supplying the house. It pumps air into the receiver as it is being exhausted, and maintains an approximately regular pressure. If the pressure of the water in the pipes reaches twenty to thirty-five pounds, it will be sufficient for all ordinary purposes, as the pump will act until equality is established between the pressure of the air and of the water. It is a great saving of labor and attention. The one in my office is known as "The Reliance," and was promoted from its original purpose of furnishing air pressure to beer barrels, to its present use. It is a handsome fixture, and can be obtained from Mr. Harvey, of Washington, put in position, for about forty dollars. A metal pipe runs from my receiver (which is on the floor) over my table, and is attached to the wall. This contains several stop-cocks, to which may be attached as many different apparatus for spray; between them and the reservoir is a governor which can be set to give the measure of air-pressure desired. By this last item guessing at the amount of pressure is avoided and accuracy may be secured.

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[1] Since the writing of the above and after using the apparatus, I find an account of something of the kind used for experimental purposes. Barth, Archiv. Otol., vol. xv. p. 160.

The local application of iodized air will be followed by a feeling of warmth and an increase of secretion from the nares and pharynx, before it is perceptible in the ear by the patient, or before the surgeon can assure himself of its effect upon the ear by inspection. The *feeling in the ear* has been aptly described by a young woman, as "just like when you blush." As the vapor is driven into the ear first, the reflux into the pharynx and nares serves as a measure of the impression being made in the cavity of the middle ear, for, in some instances, it is not possible to produce any sensation in the tympanum, or to derive any information from an examination of the membrana tympani in the early stages of the treatment. In advanced cases of the disease no sensation is caused by the vapor for months; but, from the time it is first felt, there is steady increase in sensitiveness, and the severity of influenza following a sitting. This artificial influenza resembles any other, except that it is self-limited and of shorter duration, continuing from two to eight or ten hours; it is more easily produced and lasts longer as the treatment progresses. The use of the vapor has not, under my observation, occasioned anything resembling general iodism.

As it is needful only to maintain a state of hyperæmia as continuous as possible, the intervals between the interviews may be lengthened with the time the effect persists. Increased impairment of hearing and aggravation of any existing tinnitus may occur during the first week of treatment, and this naturally would not be unexpected in a state of tissue-thickening, a result of the hyperæmic condition of the membrane. It is apt to be alarming to the surgeon, unless he has had one experience or more; to the patient it will be disheartening, unless he has been previously advised of its probability, although it has not been observed in all cases. Why it should happen in some instances, only, is not clear, and the percentage of cases in which it does occur has not been ascertained. That it is due to congestion is proved by its occurrence each time the treatment is begun, after an interval of rest, and by the relation it bears to the intensity of the congestion. An improvement in these symptoms, corresponding in extent to their aggravation, takes place upon a discontinuance of the manipulations, which is noticeable in a month, or less, afterward, if the treatment has continued for several months.

If improvement takes place during the use of the vapor, this will be increased, as indicated, after its suspension. Thus, generally, a gain can be decided only after a rest, which will not interfere with the ultimate result unless it lasts too long.

If the applications be too severe, or if the effect be increased by exposure to draught, or otherwise (and individuals vary greatly in liability to this accident), I have been able, with one exception, to control the resulting inflammation, by pressing against the membrana tympani a tampon of "prepared cotton," the end of which, in contact with the membrane, has been saturated with a solution of argenti nit. 1 : 100 parts. This, done early, often gives as immediate relief from pain as an anæsthetic. It should be left in position for some hours. The astringency reduces the local hyperæmia, and the tampon supports the membrana tympani and prevents its motion during the act of swallowing, or blowing the nose. The patient should be advised of the possibility of the accident, how best to avoid it, and to see the surgeon immediately when it occurs.

Iodized cotton in the external meatus is another means of using iodine. "Prepared" cotton placed in a closed vessel with crystals of iodine absorbs iodine, and parts with it again in the meatus. That this produces the symptoms, hyperæmia of the membrana tympani and external meatus, with some itching of the meatus, is proved in cases where the cavity is exposed by a perforation of the membrana tympani, as pain will result (though not when the drum membrane is entire) and will be relieved by removal of the cotton. The vapor applied to the cavity causes, in time, itching of the meatus in those cases which do well, and this fact induced me to use the iodized cotton in the meatus for its possible effect on middle ear nutrition, and that of the dermis of the meatus and the underlying glands. This application to the meatus is cleaner and more manageable than others, though it may be an advantage to substitute for it, sometimes, the ungt. hydrarg. nit. (pure, or mixed with lanolin in quantity varying to suit the condition), to the dermis. It is not in my power to say how much these aid the case, having never relied upon them alone in any instance, but they do service when the meatus is dry and exfoliating.

Electricity may serve to improve regional nutrition, as it does in trigeminal neuralgia, if a galvanic current be passed from the inferior cervical ganglion to the external meatus and to the Eustachian orifice, the difficulties being the time on the part of the surgeon required for each sitting, and the uncertainty of the result, for it would have to be tried alone to reach a decision as to its value.

To select a proper subject for this purpose, and to do it justice in respect to the individual and the agent both, is not a question of a short time. My reliance upon electricity, in controlling the action of the vasomotors of the region supplied by the branches of the fifth nerve, is decided. In none but subacute cases has my observation, however, led me to think it acts promptly, and though my limited experience of its influence in cases of atrophy is not satisfactory, yet it is my hope at some future time to make more exact and reliable statements concerning it. Where stenosis of the inferior nasal strait exists, *electrolysis* accomplishes more than any other agent, except, perhaps, thermocautery. If a small silver catheter can be introduced at all, if not, a silver probe will make an excellent conductor, and with one pole at the nape of the neck, and the probe converted into the negative pole, absorption of morbid material may be caused, sufficient to admit the passage of a small catheter at a second interview. The current need not be strong enough to cause much pain. Absorption seems to continue for from a week to a month. Whether absorption of bone-hypertrophy takes place, I cannot yet say. Mayhap some further advantage would arise from the substitution of needles inserted into the diseased tissue, under the influence of cocaine, and electrolysis tried through them. It is a decided gain to avoid the *removal* of any essential part of an organ.

The use of the *steam atomizer*, in preparing the mucous surfaces for the action of the vapor, unnecessarily consumes the time of the surgeon and his client, without compensating advantage, as the stimulation by the vapor increases the quantity and fluidity of the secretion, and accomplishes the same purpose.

A spray *through the catheter* to the pharynx and posterior nares, and even into the Eustachian orifice, of argent. nit., 1; acidi borici, 7; glycerinæ, 20; aquæ, 500 parts, gives admirable results, when astringency is desirable. Unless forced into the superior meatus of the nares, or beyond the isthmus of the Eustachian tube, it is painless.

In this paper, discussion of the hygienic management is beyond the consideration.

A surgeon who is not full of courage both for himself and his client, who is afraid of labor, or who cannot persist patiently without seeing positive and rapid tissue change, should not undertake this class of cases, for the results cannot be brilliant in the length of time required, nor in their impression upon the ignorant, but are important chiefly to those who suffer. After a spasmodic, which always means an unsuccessful, effort, the difficulty is increased by the additional discouragement to that usually felt by these people. The object is not to claim anything miraculous even in appearance, but to make a decided statement that *all* these cases are *not incurable*, even when far advanced. The condition, the course of treatment necessary and its annoying accompaniments, and the possible expense, should be contrasted with the probable outcome if the disease is neglected, and the individual should be left to decide for himself what he should do. He will often conclude to take the chance of relief, thinking he will persist, but growing weary of the slow improvement he may give it up. This, in a measure, is his own affair; but, with this possibility in view, the surgeon does not feel very desirous of the responsibility, though he may have the satisfaction that he has done right in so far as he was permitted. I have never seen an instance in which there was not an amelioration of one or more of the symptoms after a time; a better feeling about the head; an improvement in conscious mental vigor, or in the memory; less tympanic neuralgia, or less tinnitus; increased ability to sleep, which is more refreshing; or an improvement in the power of hearing. In the event that the hearing is not improved, the surgeon, unfortunately, has only the consciousness of duty performed, as the better condition being confined to the patient himself, and not being perceptible to his friends, there is no credit to the surgeon, because the individual "did not get back his hearing." The organ is beyond the vision of all interested, except the medical adviser, and no one appreciates the influence of the *subjective* disturbances, except the physician and the patient, or realizes what relief from them means to the sufferer. The patient's friends, with the best intentions, are, in fact, because of their ignorance, his worst enemies, and a stumbling-block in the path of the surgeon, for they will, by united effort, sometimes convince the patient, contrary to his better knowledge, that there has been no change, as any advantage is so slowly gained that they become accustomed to it. Not infrequently the patient will say, "If I never hear any better, it is worth all the time, expense, and trouble to be relieved of the confusion and weight I have had in my head." One individual said some time ago, that "he would be glad to continue the treatment once a week for the rest of his life for this effect alone, as it had, for some years, been growing more difficult to do brain work, and he thought he must soon give it up." He was one of those who could hear only a loud voice in a moving car, or a din of some kind; a condition which we know to be very intractable. He now hears the ordinary conversational tone three or four feet distant in a quiet room.

This affection is one of such importance to so many people, interfering with their usefulness to society, their personal comfort and happiness, and the convenience of those brought in contact with them, that all knowledge in regard to it repays the endeavor. A faithful consideration of my contribution will prove it rational and in the right direction, so far as it goes, and it is hoped my *confrères* will give the patient attention and trial that the establishment of a reliable means of relief from this disease would deserve. Whatever this means may be, it cannot be speedy in face of the character of the disease. The treatment described unquestionably relieves *some* cases; it has been serviceable to nearly all for whom it has been tried. If some exist who would derive no benefit from it, *why not?* This is an important question, and it may be properly answered, that the trial was not long enough continued.

We must bear in mind that in all these cases the individual, or his friends, have been aware that something was wrong for years, and, knowing its rate of progress after the disease manifests its presence, we may confidently reason that it had been existent a very long time before that, so to impair the organ as to produce troublesome symptoms. A proportionate time and effort must be given to its relief. We patiently and persistently treat a chronic conjunctivitis and its sequelæ, and are encouraged to continue by our observation of the structural changes resulting from our efforts, and we must be guided and encouraged in the same way while attempting to improve this condition. We cannot rely entirely on restored function as evidence, for these people are more miserable than the blind, when they become profoundly deaf, without the element of maddening tinnitus which is so often present, and which so wears on the physical strength and the mental equilibrium, ceasing neither day nor night, that it must be an important factor in the causation of insanity and suicide. From a humanitarian view the result striven for is great, and any one who has even temporarily suffered in this way can appreciate what it must mean to be without hope of relief—*incurable.*

BACTERIOLOGY.

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Of the methods of investigating bacteria, there are three that are most important, viz.: (I.) The study of their characters by the aid of the microscope; (II.) their investigation by means of cultivation; and (III.) the study of their relation to the living body. The chemistry of their products is also very important, but the methods of chemical analysis can be found in works on chemistry and need not, therefore, be detailed here.

I. Microscopical Investigation.

It is unnecessary to go into details as to the construction and the theory of the microscope, but I may mention the chief practical points in using it. The objects being minute and delicate, accurate illumination and fairly high angled lenses are necessary.

The lenses required are a low power ($\frac{1}{2}$ inch) for adjustment, an intermediate power ($\frac{1}{4}$ or $\frac{1}{6}$ inch) to get a general view of the relation of parts, and high powers for exact examination. Of the high powers, the oil immersion lenses are the best, for two reasons: in the first place they are high angled and give a good picture and more light, and in the second place an adjustment collar is not absolutely necessary, and thus much time and trouble are saved. For most purposes $\frac{1}{12}$ oil immersion is sufficient, but $\frac{1}{18}$ and $\frac{1}{25}$ may also be obtained. The latter lenses not having, as a rule, such a high angle of aperture as the $\frac{1}{12}$, do not really show more detail; they merely show the objects larger.

Dry and water immersion high power lenses must be provided with a correction collar which enables the front and back lenses of the combination to be approximated or separated according to the thickness of the cover-glass; and, as cover-glasses vary much in thickness, the lens must be corrected for every specimen. In correcting a lens a high eye-piece must be used so as to magnify the defects as much as possible. Some delicate object is fixed, such as a delicate line, a group of granules, etc., and the collar is moved in one direction till it is evident that the picture is becoming worse; it is then moved in the opposite direction till the same thing happens, and so backward and forward in gradually diminishing distances till at last the best point is determined. In the case of oil immersions, it is well, also, to have a correction collar, for the oil is never of exactly the same refractive index as the glass; but, unless for very fine work, it is not necessary to alter it when the best average position has once been ascertained.

The microscope stand should be very steady and provided with a coarse and fine adjustment. The fine adjustment should work smoothly, slowly, and equably, otherwise it will be a matter of great difficulty to bring the object into accurate focus when using a high power. This is a matter of great importance. In most microscopes where the movement is obtained merely by a screw and a spring, the fine adjustment is imperfect, the parts get dirty, and the spring does not act instantly and steadily; hence the lens shoots past the focal point and exact focussing with very high powers is almost out of the question.

In bacteriological work a mechanical stage is often of great advantage. This is particularly the case where the whole specimen must be thoroughly searched for bacteria, and also where one wishes to find and resume the study, at a future time, of any special bacterium or group of bacteria. For the latter purpose a finder is necessary, the usual plan being that the fixed part of the stage is graduated on two sides and the amount of horizontal and vertical movement is read off. By placing the specimen and the movable stage in the same position, the object will be brought into the field of the microscope. Another very good method is by using a Maltwood's finder. Rotary stage movement is not necessary.

The substage arrangements are of the greatest importance. A wide-angled condenser is essential and it should be, if possible, achromatic. The substage must be provided with a coarse adjustment by which the condenser may be raised or lowered, and for fine work a fine adjustment in addition is an advantage. There must also be screws for centring the condenser. Rotation of the substage in not necessary for bacteric work. Diaphragms of various sizes are required; one of the best forms of diaphragm being the iris diaphragm, by means of which the amount of light admitted can be varied with the greatest ease.

The proper arrangement of the illumination is one of the most important parts of microscopy, though often neglected by investigators. The first point is to centre the condenser. This is done by using the smallest diaphragm, and, after the specimen is brought into view with the low power object-glass, racking down the condenser till the ring of the diaphragm appears sharp. By means of the centring screws this ring is brought into the middle of the field. Having centred the condenser, use a larger diaphragm or none at all, and rack up the substage till the source of light is sharply in focus at the same time that the specimen is well seen. When working with lamplight it is easy to focus the source of light and to get the flame of the lamp quite sharp, but with daylight it is not so easy. In the latter case it is better to focus some object at a little distance off, such as the branch of a tree, a chimney, etc.—the focus will be almost the same for clouds or sky. The centring of the condenser may require alteration when fresh lenses are used, because the position of the axis of each lens when screwed on to the tube is not always exactly the same. Hence if, when working with lamplight the flame is seen to have moved to one side of the field when a new lens has been put on, do not alter the position of the lamp but bring the flame into the centre of the field by means of the centring screws. When using the higher objectives the condenser can be still more accurately focussed by means of the fine adjustment. The centring of the condenser requires to be done only at the beginning of the day and needs attention only when new lenses are used; the focussing of the condenser must be done for every specimen unless, indeed, slides of exactly the same thickness are used throughout. As the slides are thicker or thinner, so must the condenser be approximated or removed in order to bring the source of light to a focus on the specimen. It is thus evident that good microscopes must have a coarse adjustment for the condenser and also centring arrangements. Those which have the condenser fixed or only sliding, and no centring arrangements, are bad. Oblique illumination is not required in this kind of work.

As to the source of light, we may use daylight or artificial light. Of artificial light the best is a paraffin lamp. Each of these has its advantages. My own opinion is that for high powers lamplight is best; the source of light is fixed and the light can be accurately concentrated on the point under examination, and in this way one can get more light and can apply it more accurately than with daylight, especially if one employs the edge of the flame, which gives about four times more light than the flat flame. On the other hand, for low power work daylight is undoubtedly the best. It fills the field equally, not being more intense at one part than another, while with lamplight, if the edge of the flame is used, only a narrow streak of light is seen in the centre of the field and a general survey cannot be easily obtained, while at the same time the illumination at the one point is too intense. It must be remembered that in using a condenser a flat mirror should be employed.

Very convenient lamps for microscopical work are made by Messrs. Swift & Beck. They consist essentially of large flat reservoirs for the oil. The chimney is a metallic one with a space on one side into which an ordinary microscopic glass slide can be slipped. The chimney can be turned round so that the glass slip may be brought opposite either the edge or the flat flame. The advantages of these lamps are that having a large reservoir they burn for a long time; that the reservoir being flat the lamp can be lowered much more than usual; that the light passes through a flat instead of a curved piece of glass; that the rest of the chimney being darkened there are no reflections; that if the glass breaks a fresh glass is always at hand and that the edge or flat flame can be used at will. The only difficulty about these lamps is that the glass is very apt to break. This may be avoided by selecting a thin glass and boiling it for some hours in water or oil before using it or by turning up the flame at first only very slowly. In using the lamp the light can be reflected into the microscope by means of a flat mirror, or the microscope may be tilted so that the light passes directly from the flame into the tube of the microscope, and this is the more satisfactory method when it can be employed. With lamplight it is well to interpose a piece of blue or neutral tint glass to remove the yellow color and make the light pleasanter to the eye. For this purpose colored glass of various intensities should be at hand.

I may sum up these remarks in the following rules:

1. Use a low power objective and a low eye-piece and place the specimen on the stage of the microscope.

2. Remove the diaphragm and rack up the condenser till it almost touches the slide.

3. Bring the specimen accurately into focus and leave it so.

4. Put in the smallest diaphragm and rack down the condenser till the hole of the diaphragm is sharply seen.

5. Centre the condenser by bringing this hole into the middle of the field. (4 and 5 need not be repeated more than once.)

6. Substitute a larger diaphragm and rack up the condenser till the source of light is accurately defined—the edge of the flame, branch of tree, etc. With lamplight it is best to dispense with the mirror and to place the lamp about eight inches from the condenser.

7. See again to the focussing of the specimen and be sure that it and the source of light are both at the same time accurately in focus.

8. Substitute the high power objective, again focus the specimen, and, if necessary, focus the light still more exactly. If the light (edge of the flame) is not quite in the centre of the field, bring it in by means of the centring screws, but do not move the lamp.

9. If the objective is a high dry power or a water immersion, it must now be corrected for the thickness of the cover glass. To do this, substitute a high eye-piece for the low one, and move the screw collar alternately in one or other direction till the sharpest picture is obtained.

The centring of the condenser (4 and 5) need only be done when one sits down to use the microscope, but the focussing of the condenser and the correction of the lens must be repeated with every new specimen. At first sight it may seem irksome to do this, but very soon one learns to do it quickly, and the gain in clearness, definition, and satisfactory examination of the specimen amply repays all the trouble.

In the investigation of bacteria the microscope is used for the examination of unstained and stained specimens. Of these the most valuable are the stained specimens, but as this involves the death of the organisms it is often necessary to study them without staining in order to see their normal form and structure, and to ascertain their characteristics, especially as regards the power of movement, mode of growth, grouping, etc.

A. Unstained Specimens.—In examining unstained specimens it is necessary to cut off a large amount of light by means of diaphragms, but the other arrangements of the microscope in respect of focussing and centring the condenser must be carried out in the manner just described. The bacteria to be examined without staining may be present in sections, or growing in fluid or in solid cultivating media.

It is but rarely nowadays that one examines bacteria in sections without staining them, but this was the method chiefly employed before the affinity of these organisms for the aniline dyes was discovered. In the unstained condition it is often difficult to distinguish the micro-organisms from the tissue elements, and in order to do this with some degree of certainty the section is washed in acetic acid and then mounted in glycerine. Bacteria resist this treatment, while fatty and other materials are acted upon, and hence if groups of well-defined granules, all of the same shape and size, or of rod-shaped bodies are seen, they are in all probability microörganisms. Baumgarten succeeded in demonstrating the tubercle bacillus about the same time that Koch published his first paper on the subject, by subjecting sections of tuberculous tissue to the action of weak caustic potash; the tissue elements became invisible or less visible than usual, while the bacilli stood out markedly, having resisted the action of the alkali.

In examining pure cultivations of bacteria in fluids or solids, care must be taken not to let foreign bacteria into the cultivations from which the specimens are taken. The fluids may be obtained by using a thin platinum wire fixed in a glass rod and twisted into a loop at the end. The whole of the wire as well as the lower part of the glass rod must be carefully heated in the glass flame; when cool it is dipped into the flask, and a little of the fluid is picked up in the loop of the wire. Portions of fluid may also be removed by means of a sterilized pipette, the vessel containing the cultivation being held obliquely and the movements performed rapidly. Or, still better, a syringe may be employed, to the end of which a bent piece of glass rod is attached by India-rubber tubing; the glass rod is sterilized and introduced into the flask and a small quantity of the fluid drawn up by means of the syringe. If a small syringe with a ring at the end of the piston be employed, the whole manipulation can be done with one hand, the syringe being held in the hand and the piston withdrawn by means of the little finger passed into the ring.

The drop obtained by one or other of these methods may be examined by simply placing it on a slide and dropping a cover-glass on it. In this case care should be taken to have an air-bubble under the cover-glass, for it is often very difficult to focus a thin layer of fluid, while the margin of the air-bubble is easily defined and thus leads to the layer. This method is not sufficient if the examination is to be continued for some time, because evaporation occurs readily and also because there are very apt to be distracting currents, especially if an immersion lens be used. To avoid these inconveniences it is best to use cupped slides or glass cells. A small drop is placed on the middle of a large cover-glass, a little vaseline is put round the side of the cup or of the cell, the slide is turned upside down and dropped on the cover-glass so that the drop is in the centre of the cell, very slight pressure diffuses the vaseline and makes the cover-glass stick to the slide, and the slide is then quickly turned up so that the cover-glass is on the top with the drop hanging from its under surface. Where the observation of the drop is to be continued for some time, as where the mode of growth, spore formation, etc., is to be watched, the slide and cover-glass should be sterilized in the flame and the manipulations performed as quickly as possible. With regard to the cover-glass, care must be taken in passing it through the flame that it does not get too hot, otherwise it bends and does not lie flat on the top of the cell. If it is necessary to keep the cultivation, while under observation, at a temperature above that of the air, one or other form of hot stage must be employed instead of the cupped slide; but as the methods of using these are described in all books on microscopy, I need not go into that subject here.

Where the bacteria are growing on some solid material, a minute quantity is picked up with the sterilized needle and diffused in distilled water, salt solution (one-half to one per cent.), or cultivating fluid, and examined as above. It may also be necessary to examine bacteria *in situ* when growing on or in solid media, but this will be referred to afterward under "plate cultivations."

B. STAINED SPECIMENS.—The amount of information derived from the examination of unstained specimens is, however, comparatively small, and, therefore, in most cases recourse is had to the various methods of staining. It is only quite recently that satisfactorily stained specimens of bacteria have been obtained. The older attempts at staining were made with carmine and hæmatoxylin, but only a few species take on these stains, and in no case can the result be called good. With Weigert's discovery of the affinity of bacteria for certain of the aniline dyes, the state of matters has, however, been completely altered, and the work of Weigert, Koch, Ehrlich, and others, has led to great advances in this department of bacteriology. In resorting to stained specimens, the investigator may wish to study the bacteria alone, quite apart from their surroundings, or he may desire to ascertain their relations to the elements of the tissues in which they occur. In the former case what are termed "cover-glass preparations" are made; in the latter, sections of the tissue are employed. As the preparation and treatment of these two sets of specimens differ in several important particulars, it will be well to consider them separately.

1. *Cover-glass preparations.* These are employed when one examines bacteria in fluids, or in cultivations, etc., or when one wishes to gain an idea of the presence and probable numbers of these organisms in tissues without studying precisely their relations to the tissue elements. The method consists in spreading out the material in a thin layer on one side of a cover-glass, and fixing this layer to the glass. The material may be spread out by means of a needle, the point of a knife, etc., but the best way of obtaining an extremely thin and even layer is to take two cover-glasses, put a minute quantity of the fluid on the centre of one, drop the other glass on the top of it, press them together so as to diffuse the material over the glass, and squeeze out any superfluous fluid; then, keeping up the pressure, slide them apart and set them up on their edge to dry under protection from dust. They dry in a very short time, but if one wishes to hasten matters, they can be held in the fingers at a considerable distance above a flame; they must not, however, be actually heated while still moist, and by holding the glass in the hand instead of in forceps one takes care that they are not brought too near the flame.

In other cases the material may be too thick to spread out in the manner above mentioned; it must, therefore, be diffused in a drop of boiled distilled water. Where water is thus employed there is always the difficulty that after the cover-glasses are slid apart the water collects in drops as on a duck's back, and little heaps of microörganisms are obtained. It is therefore better when water is used not to press the drop between two cover-glasses, but to let it dry on one glass. It will be found that while at the centre there will probably be too many bacteria, at the circumference of the drop one will find satisfactory places. This is also the best way of preparing drop cultivations for staining The cover-glass from which the drop is hanging is turned over and the fluid allowed to dry. Where the material is very dense, as, for instance, a small tubercle, it is best to crush it well between two knives and then rub the crushed mass over the surface of a cover-glass, afterward removing the superfluous solid material. Lastly, we have what the Germans call "Klatsch" preparations, which are made in the following manner: As will afterward be pointed out, it is often important to study the mode in which various organisms spread over the surface of solid materials. When growth has occurred to some extent, a cover-glass is dropped over the spreading part, pressed lightly, and then lifted. The cover-glass picks up the bacteria, and when the specimen is dried and stained, one gets an exact impression of the mode of surface growth of the organism in question. These "impress preparations" are often very beautiful and valuable.

Cover-glasses prepared in any of these ways can be kept in a dry place for a long time without undergoing any change or losing their property of staining, and it is often necessary to keep a number of specimens of the same material either for future reference or for trying new stains or testing the activity of staining fluids which may have yielded negative results with other specimens. This is especially the case with tubercle. The stain ordinarily used for staining tubercle bacilli is very apt to go bad in a few days, and, therefore, I always keep a number of prepared cover-glasses of sputum or other material rich in tubercle bacilli at hand, so that if a negative result is obtained I can stain one of these glasses and see whether the result is due to some fault in the stain or to the absence of bacilli.

A layer having thus been obtained, it must be fixed before proceeding with the staining. If the layer contains albumen, the albumen is not coagulated by simple drying and, therefore, when placed to stain in a watery solution the albumen dissolves and the layer becomes detached. And even if any portion of the layer remains, that is not of much use, as precipitation of the stain occurs in connection with the albumen. It is, therefore, necessary to coagulate the albumen before proceeding with the staining and at the same time to retain for bacteria and nuclei their power of taking up the dye. This was done by Koch at first by placing the cover-glasses for some days in absolute alcohol. But this is a tedious method and one of the great advantages of these cover-glass preparations is that they can be prepared and stained in a very short time. Ehrlich found that if cover-glass specimens of blood were kept for an hour at 100° C. to 115° C. the desired coagulation was obtained without interfering with the staining of the nuclei, etc. Koch has applied this method to bacteric work, and at first recommended placing cover-glasses for an hour in an iron chamber kept at about 110° C. Ehrlich's method is simpler. He takes a long strip of metal, supports it on a tripod, and places a Bunsen's burner under one end. After about a quarter of an hour a wet rod is drawn over the metal from the cool end toward the flame. At a certain point it will be seen that the water boils. That line is, therefore, at 100° C. and its exact position is carefully ascertained. Cover-glasses with the coated surface upward are laid on that line or a little nearer the flame and kept there for an hour. As the best temperature varies for different materials, it is easily ascertained by using three or four cover-glasses and laying them at slightly different distances from the flame. One of them will be good.

Where one wishes to obtain really beautiful specimens for preservation the above is the best method, but it has been found that sufficiently good specimens are obtained by seizing the cover-glass in a pair of forceps with the spread side upward and passing it fairly rapidly three times through a glass flame (about as rapidly as one cuts bread—Rindfleisch). If it is passed too often through the flame, or if it is heated too long on the metal plate, the bacteria lose their property of taking on the stain.

Having thus prepared the specimens they must next be stained. This is much easier to do in the case of cover-glass preparations than in that of sections, but different kinds of bacteria stain differently. One of the most satisfactory stains to use is a fairly strong watery solution of methyl-violet. I do not make it up on any precise formula, but add a stock saturated alcoholic solution of methyl-violet to distilled water till a deep color is obtained. I should guess that the proportions are about one part of the methyl-violet to ten parts of water. A few drops of this are filtered into a watch-glass and then the cover-glass being held between the finger and thumb with the covered side downward, it is dropped on the stain and allowed to float there for five or ten minutes. It is then removed and washed repeatedly in dilute acetic acid (one-half to one per cent.) till no more stain comes out. It is afterward rinsed in distilled water and examined in the water. If a permanent preparation is required, it is then dried in the air and when quite dry is mounted in Canada balsam. If it is dried at a high temperature, the stain disappears and this is the case with all stained specimens; they should not be heated after staining. The specimens should always be examined in water in the first instance, because there the bacteria swell out to their natural size (more especially when acetic acid is used), whereas they dwindle and shrink somewhat when dried and mounted in Canada balsam. The use of acetic acid in the manner described above is much more satisfactory than that of alcohol for removing the superfluous stain and differentiating the nuclei and bacteria, and if the specimen is somewhat overstained to start with there is no danger of leaving it too long in the dilute acetic acid.

The Canada balsam is best employed in the form of a solution in xylol. The only other solvent that can be used is turpentine, as chloroform and benzol extract the aniline colors. Undissolved balsam cannot be used, for the heat required to dissolve it is apt to remove the stain from the bacteria.

Gentian-violet may also be employed in the same manner, or in a one per cent. watery solution, but the color is hardly, I think, so pleasant as that of methyl-violet, and for cover-glass preparations it does not possess any advantage. One of the quickest stains is a watery solution of fuchsin. This should be almost saturated and well filtered. If it is quite saturated precipitation is apt to occur on the specimen as evaporation takes place. The cover-glass is laid down with the spread side uppermost and a drop of the stain is placed on it. After about a minute the stain can be washed off with distilled water or weak acetic acid and the specimen examined.

Methylene-blue is almost more universally useful than methyl-violet, but the stain is not so intense. It may be used in the form of a strong watery solution, or it may be made in the same way as methyl-violet by the addition of a saturated alcoholic solution to water, but in larger proportions than in the case of methyl-violet. The watery solution stains a light blue or almost a green, but a beautiful deep blue is obtained if a little methylic alcohol be added to the solution, or if the saturated alcoholic solution be made with methylated spirit instead of with absolute alcohol. After staining in methylene-blue acetic acid should not be employed; simple washing with distilled water is sufficient.

The staining power of these solutions may be increased in two ways: either by warming the solution, or by the addition of various bodies, chiefly alkalies, and the alkaline solutions also act more quickly and powerfully when warmed. These facts were first made out in connection with Koch's discovery of the tubercle bacillus, and have since been extended to other bacteria.

Koch's first method of staining the tubercle bacillus was by the use of an alkaline solution of methylene-blue. He first made a watery solution of caustic potash of the strength of 1 to 10,000. To every 200 c. cm of this solution he added 1 c. cm of a saturated alcoholic solution of methylene-blue. The cover-glasses, which are prepared from tenacious pieces of yellow sputum or from crushed tubercles, are floated on this solution for twenty-four hours or longer, and are then placed in a saturated watery solution of vesuvin or Bismarck-brown for twenty to thirty minutes. They are then washed in water and examined at once or dried and mounted in Canada balsam. As the result of this treatment all bacteria, nuclei, etc., become in the first instance intensely blue, but the effect of the vesuvin is to substitute itself for the blue in the cell nuclei and in all the bacteria except the tubercle bacilli. The effect is that we have blue-stained tubercle bacilli on a brown ground. This method is, however; somewhat difficult to carry out, and it is somewhat difficult to see the tubercle bacilli, hence the plan was very soon improved.

The first improvement and that which still holds the field, was the use by Ehrlich of aniline oil instead of alkalies. Ehrlich's original plan was to make a watery solution of aniline oil by shaking up the oil with water (about three per cent. of the aniline is taken up) and filtering the turbid mixture through a moist filter. To this was added a saturated alcoholic solution of fuchsin, methyl-violet, or gentian-violet, till precipitation began to occur. Weigert has worked out the best proportions in which these two should be mixed, and gives the following formula:

Saturated watery solution of aniline	100 c. cm.
Saturated alcoholic solution of fuchsin, methyl-violet, etc.	11 "

The cover-glass is floated on this solution for about twenty-four hours at the ordinary room temperature, but three or four hours are quite sufficient at the body temperature, and if the staining fluid is heated almost to boiling a few minutes are enough. The most satisfactory result is obtained when the material is kept at the body temperature for two or three hours. When the cover-glass is removed from the staining fluid the whole layer is intensely stained and the individual structures unrecognizable. It is now immersed in dilute nitric acid (1 part of strong nitric acid to 3 or 4 parts of water) for a few seconds till the layer becomes bleached. The result of this is that while the stain remains fixed in the tubercle bacilli it is, so to speak, loosened in the other elements and easily removed by means of alcohol, or displaced by a contrast stain. If the cover-glass is washed in water after being taken out of the nitric acid the color returns (red or violet, according to the stain used) and is then less easily displaced. Hence some advise that the cover-glass should be placed at once in alcohol not quite absolute, after being removed from the nitric acid, but my own impression is, that it is better to wash away the acid first in water, as acid alcohol is apt to remove the stain from the bacilli unless they are very well stained. In any case, when the cover-glass is placed in alcohol it is left till no more stain comes out, and is then stained with a contrast stain, either a watery solution of methylene-blue made up as before described, if the primary stain was fuchsin, or a saturated watery solution of vesuvin if the primary stain was violet. When sufficiently stained they are washed in water and examined, or dried and mounted in balsam. The result is that the tubercle bacilli are red or violet as the case may be, and the nuclei of the cells and the other bacteria are blue or brown. Treated in this way, the only other bacteria, so far as is yet known, which retain the primary stain are the bacilli of leprosy. The spores of some large bacilli retain the primary stain, and elastic tissue and cheesy matter, especially the former, also retain it to some extent.

Stains made up according to the above formula become bad in a few days and must therefore be frequently renewed. This difficulty has been got over by avoiding the use of alcohol altogether, and the fluid now used in Koch's laboratory for Gram's method, tubercle bacilli, etc., is made up as follows: A saturated watery solution of aniline oil is made and filtered as above. This solution is then employed for preparing a saturated watery solution of fuchsin, methyl-violet, or gentian-violet, a large quantity of crystals of these substances being put into a bottle containing the aniline water. The fluid is filtered before use, and when exhausted fresh aniline water is added as long as any crystals remain at the bottom. This staining fluid remains good for a long time.

The mode of action of the aniline is not very clear. Ehrlich used it on the supposition that the difference in staining reactions between ordinary bacteria and tubercle bacilli depended on the tubercle bacilli possessing a sheath which can only be penetrated by coloring matters in the presence of alkalies, and which becomes impenetrable after the use of acids. But there are various facts which render it doubtful whether alkalinity is the essence of the matter. My own idea is that the aniline acts merely as a sort of fixing agent. I found[1] in my investigations on tuberculosis that the tubercle bacilli could be stained by the ordinary dyes without any aniline, but that only a few of them, probably at a certain stage of growth, could retain the stain in the presence of strong nitric acid. This is what the aniline enables them in some way or other to do. Other investigators, especially Baumgarten, have also found that these bacilli stain without the aniline. And even in the case of other bacteria the addition of aniline to the stain is an improvement, and indeed almost an essential in some instances.

Other substances have been employed to replace aniline, and with a considerable degree of success. The chief of these is a five per cent. solution of carbolic acid, first suggested by Dr. Franz Ziehl. Neelsen has modified Ziehl's solution and suggests the following:

Fuchsin	1 gramme.
Absolute alcohol	10 c. cm.
5 per cent, watery solution of carbolic acid . .	100 c. cm.

This is used in the same manner as the Weigert-Ehrlich solution, or the stained cover-glasses may be washed in a watery solution of sulphuric acid (25 per cent.), instead of in nitric acid. The carbolic stain gives very brilliant results. Ziehl also succeeded with resorcin and pyrogallic acid, but the results are not so good. I have tested other substances, the best of these being phloroglucine, which acts almost as well as aniline. Toluidine is also good. Weigert recommends the following solution:

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[1] Practitioner, April, 1883.

Liq. ammon. fort.	5 c. cm.
Absolute alcohol	10 c. cm.
Distilled water	90 c. cm.
Gentian-violet	2 grammes.

This is used in the same manner as the others.

Gram's method of staining bacteria gives beautiful results in some instances, but it is not often necessary to use it in cover-glass preparations. Hence we may leave its detailed description till we come to sections, and the same may be done with regard to the other special methods, such as those for syphilis, double staining, etc.

Staining with vesuvin or Bismarck-brown was at one time much used in order to obtain specimens for photography, but since the introduction of the new plates by which blue and red stained specimens may also be photographed, this has fallen into disuse. One way of using the brown is to stain in a saturated watery solution of vesuvin, wash in water and examine, or dry and mount in Canada balsam. The method recommended by Koch was, however, to make a concentrated solution of vesuvin or Bismarck-brown in equal parts of glycerine and water, filtering before use. The specimens were afterward mounted in glycerine.

Quite recently it has been found that spores which, when completely formed, remain unstained when treated with the ordinary aniline dyes, can be stained by a special method. Koch and Gaffky noticed, when staining material containing tubercle bacilli with aniline methyl-violet, that not only the tubercle bacilli, but also the spores of a large bacillus retained the blue, while the other bacteria, and indeed the bacilli containing these blue stained spores, took on the brown stain. Hence there was here a differential staining of spore and adult bacillus. By using the same method, however, the spores of other bacteria could not be stained, but Neisser succeeded in getting double staining in other cases by using warm aniline fuchsin, and subsequent staining with methylene-blue; the spores remained red, the rest of the rod became blue. Buchner and Hueppe have worked out the matter, and Hueppe has obtained both isolated staining of spores and double staining of spore and rod. The isolated staining of the spore is managed in this way: if the cover-glass is passed through the flame oftener than three times, the staining property of the bacteria and protoplasm is diminished, and after passage through the flame six or ten times they do not stain at all. On the other hand, after the preparation has been passed through the flame from seven to ten times the spores acquire the property of staining with watery solutions of the basic aniline dyes, so that an isolated staining of the spores is the result. Hueppe also obtains double staining in the following manner: The cover-glass is passed through the flame three times, and then stained for ten to twenty minutes in a warm solution of aniline fuchsin (as used for tubercle). After removal from this solution it is washed in water, and then either stained with methylene-blue or placed for a few seconds in absolute alcohol, and then in the contrast stain. The spores come out red, the bacilli blue.

The flagella with which some bacteria are provided are said not to take on the aniline dyes, though I doubt if this statement is correct in all cases. On the other hand, they can be stained in a concentrated watery solution of hæmatoxylin.

Much more difficult than these cover-glass preparations is the manipulation of sections of the tissues. In this connection we have to consider the methods of hardening, of cutting, and of staining.

2. *Sections of the fresh tissues* may be made by means of freezing microtomes without any preliminary hardening, but the sections are not easily manipulated and in many cases the staining is most unsatisfactory. Hence it is best, whenever possible, to harden the tissues. If the fresh tissue is cut, the sections should be received in salt solution (one-half per cent.), and then placed by means of a spatula in absolute alcohol for a few minutes. From this they come into the staining fluid, and the best, for this purpose, is a saturated watery solution of vesuvin.

Of the hardening reagents the most useful is absolute alcohol, but Müller's fluid or a strong watery solution of bichloride of mercury may be employed. The tissues must be cut up into small pieces and placed in a large quantity of absolute alcohol, which should be frequently changed. Treated in this way the tissue is sufficiently hardened, and, indeed, in its best condition for staining in about three days. After several weeks' immersion in alcohol some bacteria do not stain so well as at first, and hence to keep the tissues permanently one should not use absolute alcohol, but a weaker alcohol: methylated spirit does very well for this purpose. In Müller's fluid (potassium bichromate, 2 grammes; sodium sulphate, 1 gramme; distilled water, 100 c. cm.) the tissues must be kept for from two to three weeks and are then ready for cutting, or after removal from Müller's fluid they may be placed in dilute alcohol and then transferred to and preserved in strong alcohol.

The tissues hardened in alcohol are best cut with a microtome, either a freezing microtome, or one for cutting under alcohol. If a freezing microtome is used, the alcohol must be first removed from the tissue by placing it in a large quantity of water. At first the tissue floats but after a short time it sinks, and in an hour or two it may be placed in a thick solution of gum. It remains in this for some hours to allow the gum to soak thoroughly into it. It is then frozen with either an ice or ether freezing machine. The best freezing microtome is, in my opinion, Williams's, and this can be easily arranged to act with ether. If ice is used, a few drops (six or eight drops per ounce) of methylated spirit should be added to the gum to prevent it freezing too hard, but with the ether machine this is not necessary as it is quite easy to regulate the degree of hardness of the gum. When cut the sections are placed in tepid water to dissolve out the gum, and are then removed to alcohol before being placed in the stain. In the case of Müller's fluid, the tissues may be placed at once in gum and then treated in the same way as the other.

At one time I used to prepare all the sections in this way, by first hardening the material in alcohol and then freezing, because very fine sections were thus obtained, but though this plan answers very well in the case of some bacteria, such as tubercle bacilli, I have come to the conclusion that on the whole a better result is obtained if the tissues are not placed in water after hardening, but are cut under alcohol. And after all, though the sections are a little thicker, this is no disadvantage, for one is less likely to miss the bacteria if they are few in number than when a very thin section is employed. For this purpose Thoma–Jung's microtome is the best. The bits of tissue are fixed on pieces of cork which can be grasped by the clamp of the microtome. The specimens are easily fixed on the cork by means of a mixture of gelatine and glycerine prepared in the following manner: Dissolve 5 grammes of gelatine in 10 c. cm. of distilled water, and then add 20 c. cm of glycerine. A minute portion of this is melted by heat and placed on a smooth piece of cork of suitable size and shape; on this the piece of tissue, from which the superfluous alcohol has been sucked off by means of blotting paper, is placed and the cork is then put into absolute alcohol. The glycerine jelly becomes quite firm after being left for a few hours in alcohol. Where the tissues are friable they must be embedded in paraffin or celloidin, best in celloidin. The tissue after having been hardened in alcohol is placed for some hours in a mixture of alcohol and ether. It is then removed to a solution of celloidin in equal parts of alcohol and ether and left for some hours. It may then be fixed on a cork by means of celloidin or laid in a paper mould filled with celloidin. In either case the specimen with its coating of celloidin is placed in an eighty-two per cent. alcohol to harden and is then cut as before. After the sections are cut they are put into alcohol.

The methods of staining differ for different bacteria, but are very similar to those described under cover-glass preparations. Where sections are being examined for unknown bacteria, the best solution to employ is probably Löffler's alkaline methylene-blue. The formula is:

100 c. cm. of a 1 to 10,000 solution of caustic potash.
30 c. cm. of a saturated alcoholic solution of methylene-blue.

The sections are left in this solution for from half an hour to an hour, and are then washed in distilled water or in dilute acetic acid (one-halt per cent.). If they are washed in acetic acid they must again be put in water to remove all the acid. They are then placed in alcohol to remove the water, then in oil of cedar, in which they may be examined or from which they may be mounted in Canada balsam dissolved in xylol. Oil of cloves should be avoided in all cases, as it is apt to dissolve out the stain from the bacteria.

The original method introduced by Weigert and Koch was to stain in a saturated watery solution of fuchsin, gentian-violet, or methyl-violet, or in a solution made as before described by adding a saturated alcoholic solution to water. From this the sections were transferred to water and then, in order to have only nuclei and bacteria stained, to dilute acetic acid; afterward to water again, alcohol, oil of cedar, etc. The acetic acid is, however, very apt to remove the stain from the bacteria, and hence it has been found best to give up acetic acid and use alcohol for differentiating the nuclei and bacteria. Thus, after being washed in water, they are at once placed in alcohol.

It is better when employing these stains to use the solutions in aniline water, because a deeper stain is thus obtained, and also because more bacteria take on the stain than when the plain watery solutions are used. The best stain is the saturated solution of gentian-violet, fuchsin, etc., in aniline water. This stains in fifteen to thirty minutes and the sections may or may not be washed in dilute acetic acid.

In sections stained in this way a double stain may often be obtained. Sections stained in aniline gentian-violet and washed in alcohol may be placed for a short time in a dilute alcoholic solution of eosin, and then again washed in alcohol and placed in oil of cedar. The result is that the bacteria and nuclei are blue and the remainder of the section rose-colored. In the same way violet stained specimens may be placed in various carmine solutions (chiefly picrocarmine), when the nuclei come out red and the bacteria violet, or specimens colored red may be stained in hæmatoxylin. In these cases, however, it is best to employ Koch's method of obtaining isolated staining of the bacteria before staining in the contrast stain. This is done by placing the sections, after being stained, in a solution made of equal parts of a saturated solution of potassium carbonate and distilled water. They remain there five minutes and are then transferred to alcohol.

One of the most beautiful methods of staining is Gram's method, but, unfortunately, only a few bacteria stain in this way. The sections are stained either in the Weigert–Ehrlich tubercle solution or in the saturated aniline solution of gentian-violet. Twenty to thirty minutes suffice. They are then at once placed in a solution of iodine (1 part of iodine, 2 parts of potassium iodide, and 200 parts of water) for five or fifteen minutes. Thence they are transferred directly to alcohol and left there till no more stain comes out. (It is frequently necessary to change the alcohol several times.) The result is that the section has a faint yellowish tinge while the bacteria appear of a blackish-blue color. These sections can then be double-stained by immersing them for a short time in a dilute solution of vesuvin, or, better, by placing them in a solution of picro-lithium carmine (1 part of lithium carmine and 3 parts of picric acid). In fact, the best way is to stain the sections first in picro-lithium carmine, then wash them in alcohol, and then stain with Gram's method; the nuclei and tissues retain the picrocarmine while the bacteria take on the gentian-violet. In this case care must be taken that the picrocarmine is fresh, for bacteria are very apt to grow in it, and, if that has occurred, when the specimen is afterward put in Gram's solution the bacteria adhering to it are stained, and mistakes are thus apt to occur. In staining with Gram's method the sections must not be put in water at all, and, indeed, it is important to remember in all these methods that it is best to put the sections straight from the alcohol in which they were first placed, after being cut, into the staining fluid and not to wash first in water.

Tubercle bacilli are stained in the same manner as described before under cover-glass preparations. The aniline fuchsin is the best solution to use, as the preparations are more permanent than those stained by gentian-violet. Various attempts have been made to get rid of the nitric acid, as it is apt to spoil the sections if they are very thin. In my paper on tubercle I suggested the following method: After staining the sections in Weigert-Ehrlich's fuchsin solution, wash in alcohol, and then place in the following:

Distilled water	100 c. cm.
Saturated alcoholic solution of methylene-blue . .	20 "
Formic acid	10 minims.

The sections are left for one or two hours in this solution and then washed in water, alcohol, etc. This method is not so certain as the older plan and, therefore, I only suggest its use for very delicate sections which are apt to be spoilt by the nitric acid.

Orth uses acidulated alcohol instead of nitric acid (one part of hydrochloric acid to 100 parts of 70 per cent. alcohol). Neelson employs dilute sulphuric acid as mentioned before. Other workers also employ acidulated alcohol. In fact, the acid is not absolutely necessary, for the contrast stain will ultimately replace the first stain in everything but the tubercle bacilli if it only acts long enough; indeed this was what occurred in Koch's original plan with methylene-blue and vesuvin. Gibbes has suggested a double stain in which the bacilli become red and the tissues blue, but, unfortunately, this does not give thoroughly reliable results.

Leprosy bacilli stand midway between ordinary bacteria and tubercle bacilli in that they can be stained by the ordinary stains, more especially by methylene-blue, while they also have the same reactions as tubercle bacilli in resisting the nitric acid after staining with Weigert-Ehrlich's solution. In fact, this is the best way to stain them.

Lustgarten has described bacilli in sections of gummata and other syphilitic products which stain in a characteristic manner. His method is the following: the sections are stained in the Weigert-Ehrlich gentian-violet solution in the same manner as for tubercle bacilli. They are then placed for a few minutes in alcohol and then for ten seconds in a one and one-half per cent. watery solution of potassium permanganate From this they are transferred to a watery solution of pure sulphurous acid. The specimen becomes bleached in a few seconds. If it is not sufficiently bleached it is washed with water and put back in fresh permanganate solution for two or three seconds and then again into sulphurous acid. This is repeated till the specimen is completely bleached; it is then washed with water, alcohol, etc. The bacilli come out violet, the rest of the tissue is colorless. They differ from tubercle and leprosy bacilli, which are also stained by this method, in that the syphilis bacilli are decolorized by the nitric acid method. De Giacomi suggests the use, first, of a dilute, and then of a concentrated solution of ferric chloride instead of the potassium permanganate and the sulphurous acid. In the healthy smegma, Alvarez and Favel have also found bacilli which show the same reactions and are of similar appearance, and their statements have been confirmed by others.

Several other bacteria are difficult to stain, but the peculiarities of each kind will be referred to later. Typhoid bacilli are best stained with the alkaline methylene-blue, and so are the bacilli of glanders, which are very difficult to stain. The spirilla of relapsing fever stain in cover-glass preparations of blood with methyl-violet, fuchsin, etc., but in sections the best solution is a watery solution of vesuvin or Löffler's methylene-blue solution.

For fungi in the tissues the methylene-blue solution is the best. For actinomyces Weigert recommends a solution of orseille dissolved in a mixture of 20 c. cm. of absolute alcohol, 5 c. cm. of acetic acid, and 40 c. cm. of distilled water, till the fluid is dark red. The sections are stained in this for an hour, then washed in a one per cent. watery solution of gentian-violet, and afterward in alcohol, oil of cedar, etc.

The rays of the fungus are stained bright red and the nuclei of the tissue violet.

In examining stained specimens with the microscope the focussing of the light, the centring of the condenser, and the correction of the lens must be carried out as carefully as in the other case, but instead of a small diaphragm a large one or no diaphragm at all must be employed. The reason is this: in the unstained specimen one wants to see as much of the structure picture as possible and, therefore, light must be shut off; but in stained specimens the stained objects would only be obscured by the structure picture, whereas they are quite as easily recognizable in a flood of light, while the structure picture disappears. The only objections to the entire absence of a diaphragm are, first, that if the light is very intense it is painful to the eye, and secondly, that it is only a very good lens that can stand the complete absence of the diaphragm, for if the lens is imperfect the image appears blurred.

Before examining specimens mounted in balsam with an oil lens it is well to surround the margin of the cover-glass with some material impermeable to oil, such as shellac, and allow this to harden before use. Hence, the investigation of the specimen, in the first instance, is made with the specimens in oil of cedar, and only when it is desired to preserve the specimen is it mounted in Canada balsam.

INTESTINAL CONCRETIONS RESEMBLING SAND, AND ORIGINATING IN CELLS FROM THE BANANA.

By N. L. Bates, M.D.,
MEDICAL INSPECTOR U. S. N.

Obscure and puzzling cases may eventually prove to be unexpectedly plain. What has been done by one is liable to be repeated by others; hence the history of my cases and of the efforts made to ascertain the nature of the unknown substance which caused them may save time and trouble to some one who might otherwise become involved in a search similar to my own.

Four years ago I washed from the fecal movement of a child a half ounce or more of siliceous, organic cells, closely resembling in external appearances fine black sand. Since that time these cells have been examined by many of the ablest chemists, microscopists, and physicians of the country, who were unable to give any information as to their origin, or even to decide whether they belonged to animal or vegetable life. Twice I read articles on the subject before societies; in one instance before a large audience representing almost every branch of scientific research. Specimens were shown, both in the natural state and with the microscope, but no one present identified them with any known cells. The specimens had been seen and examined by more than a hundred physicians and microscopists, when Dr. Robert T. Edes recognized them as probably of similar origin to those he had described in the Boston *Medical and Surgical Journal* of May 10, 1883, and which had been identified as coming from the banana. My cases are as follows:

Case I.—Yokohama, Japan, July, 1882. Eva M., aged five years. Only child of American parents, both living; a pale, delicate-looking girl, sedate and precocious, with a history of indigestion, habitual constipation, and occasional attacks of gastric catarrh. The constipation and indigestion commenced when the child was two years of age, and were without apparent cause, but led to such care and watchfulness on the part of the mother and other members of the family that every minute detail of the child's life could be given.

On my first visit, the patient had fever, vomiting, gastric pain and tenderness, a tense, hard abdomen, and constipation. The bowels were relieved with great difficulty. Frequently repeated and large enemata were thrown well up the bowel, but the atony of the intestine was so great that the water was retained and oozed away on a folded sheet placed under the hips. I noticed one morning that this sheet was liberally sprinkled with a fine black sand; the mother said that these gritty particles came from the bowels, caused the child much uneasiness, and that she had folded the sheet differently several times on account of them. They were clean, and there was no appearance of fecal matter or discoloration on the sheet. I saved some of the deposit, and directed the mother to send me the first fecal movement, and as much of the sand as she could gather. Shortly after, the obstruction yielded to an enema containing one-half ounce fluid ext. of senna, and an enormous and very offensive fecal movement was obtained. The mother sent me only a small portion of it, from which I washed a tablespoonful or more of a substance closely resembling in general appearance fine black blotting sand. I am unable to state how much there was in all, but the mother of the child estimated the amount as two teacupfuls of sand in a chamberful of feces.

The relief was immediate, and practically the end of the case. A month later there was a lighter attack of similar character, but no obstruction in the intestine and only a small quantity of the black deposit. The child passed from under my care a few months later, returned to the United States, and died of diphtheria about two years afterward. Up to the time of her death there were no severe gastric or abdominal attacks, and although carefully looked for, no more black specks were ever seen. Had there been any, I am sure they would not have escaped recognition.

Case II. occurred in Washington, November, 1885. This was the youngest of several children of parents both living, a girl, six years of age, with a pallid, muddy complexion, and a history of malaria, constipation, pasty clay-colored stools, and worms (?). There was a distended but tympanitic abdomen, pain in the left side just below the ribs, but no acute symptoms. The urine was normal, and no enlargement of liver or spleen was detected. It was only because I was attending another child in the same family that my attention was called to this case. The mother stated that at frequent intervals, for two years, she had given the child santonin and castor oil for worms, and always with good effect. No worms had ever been seen, only "eggs and skins." I prescribed the same remedies, and requested that all the movements should be saved. The result was the same as on previous occasions, but the so-called worm skins were long strings and shreds of tough mucus, and the eggs, although in small quantity, at once recalled my Yokohama experience.

I have heard of three, perhaps four, similar cases; one in Japan, one in Washington, one in Ohio, and the fourth in Massachusetts. Of the first, Dr. Stuart Eldridge, of Yokohama, writes:

CASE III.—"The child was, in this case, though stout and fairly strong for its age, three years, and previously, according to the mother's account, perfectly healthy, of a pasty complexion, and for some days before I saw it troubled with colic-like pains, which were relieved by a stool, to recur spontaneously within twelve to twenty-four hours. I was sent for because the mother detected the abnormal particles in the stool; these were so plentiful in the specimen I examined as to form nearly one-fourth of the whole mass, the amount sent me being that of a good copious evacuation." "The grains were exactly like those" in the Eva M., Yokohama case. This case was not seen again, and no further history obtained.

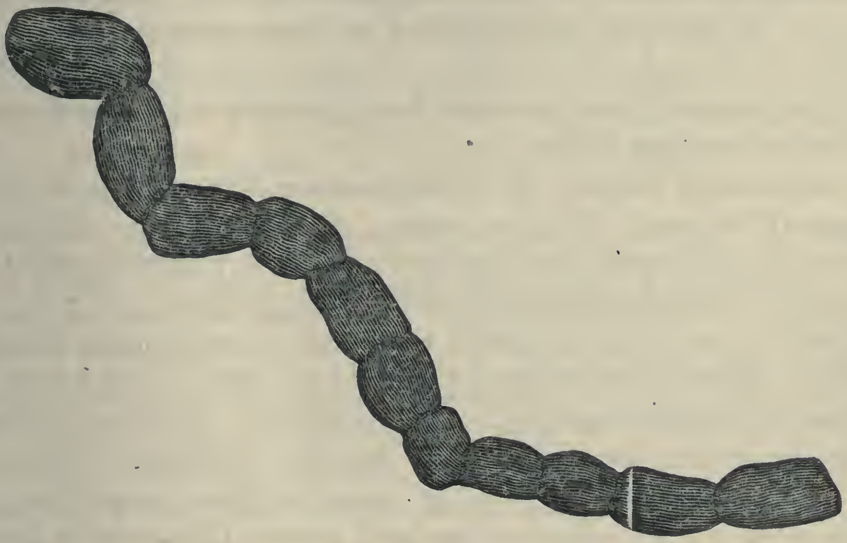
CASE IV. is reported to me by Dr. C. H. H. Hall, U. S. Navy. His own child, a boy, three years of age, passed a half teaspoonful of black, sandy-looking grains after a dose of santonin and castor oil had been given—none had ever been seen before, and although looked for, none have been seen since. No examination was made, but in general appearance they resembled my specimens.

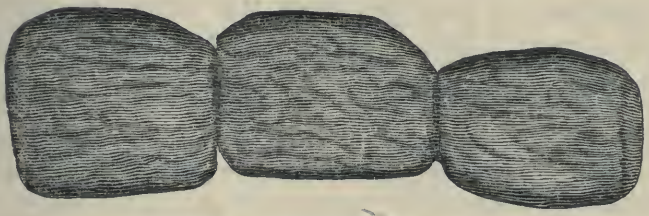
CASE V.—The clinical history is wanting. Prof. Romyn Hitchcock received some years ago, from a physician in Ohio, specimens which he is quite sure were the same as mine, but he does not now know who sent them nor the history of the case.

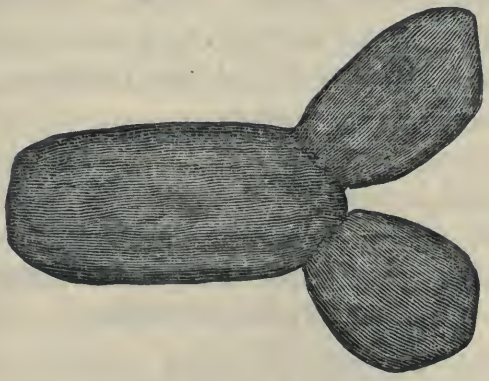
I have been promised the details of a case occurring in the practice of a physician in Salem, Mass., but have not received them.

In my cases the cells were of such peculiar character that identification would have seemed comparatively easy; yet it was in their most striking characteristics that they differ from the banana cells in their natural state, where they are white, translucent, and only resemble in size and form the objects from the intestine. If a transverse slice of banana is placed in a watch-glass and covered with strong nitric or sulphuric acid, a double row of cells, with a spiral fibre between, will become visible, enclosing three lobes in the centre of the slice, and the cells will eventually become of a garnet-red color. They are not so deep in color as my specimens, and have not the weight and resistance, but otherwise resemble them closely.

The cells from my Yokohama case could not be readily cut or crushed; were deep red-brown in color; had a sp. gr. 1.59; and contained four per cent. of silica. With the naked eye and sense of touch they could not have been distinguished from so much blotting sand. As passed from the bowel on the sheet they were perfectly clean, free from fecal or other adherent matter, with nothing to give any clew to their origin, except size, form, and the manner in which they were joined together, and in none of them was there anything which could indicate a probable source. Their appearance under the microscope is well shown in the accompanying illustrations.







One of my patients, so the mother said, had never eaten fruit of any kind. In answer to a direct question, however, she admitted that the child had occasionally eaten a small piece of banana. The Yokohama child had eaten banana quite freely some months before I saw her; but, as the fact was not mentioned, and the fruit not at all common in Yokohama, I had no reason to suspect it. I examined the drinking water and all suspected foods, including native fruits and candies.

The Japanese persimmon was suggested as a probable source by a Japanese microscopist, but I did not find any cells in them like mine. I have recently thought, however, that treatment by nitric acid might develop them, and have requested a friend in Japan to make a thorough examination of the persimmon.

The banana may not be alone responsible for this black sand in the intestine, but with the recognition of one source, others may be more readily ascertained. The number of cases collected, and the clinical history of some of them, are enough to give these objects sufficient importance to be remembered.

A suspicion of entozoa was or might naturally have been entertained in most of the cases. So far as known, all the cases were children, and constipation was a prominent symptom. Some, but certainly not all, may have been constipated from birth, and had the elongated descending colon which Prof. Jacobi has noticed as a cause of constipation in infants.

Severi, Alberto (*Lo Sperimentale*, Firenze, 1884, xiii. 482–508) gives statistics of measurements of the large intestine in the fœtus and in children. From the seventh month of fetal life to the end of the second year of child life, the length of the large intestine exceeds the length of the child. With increased age and growth the excess is lost, and finally disappears. It may be that the more numerous folds and flexures of the large intestine of the child favor the accumulation of these objects, and that the intestine in later life is not adapted to their retention.

At all events, I am disposed to regard a prolonged stay in the intestines as necessary for the development of the deep color; hard, sharp, and gritty character; high specific gravity, and siliceous contents of these cells; and when thus developed, they are no more innocent than would be a corresponding quantity of sharp sand.

1233 Seventeenth St., Washington, D. C.

THE ACTION OF SULPHURIC ETHER ON THE PERIPHERAL NERVOUS SYSTEM.

FROM EXPERIMENTS PERFORMED IN THE PHYSIOLOGICAL LABORATORY OF THE HARVARD MEDICAL SCHOOL, BY DR. F. H. HOOOPER, DR. F. W. ELLIS, AND MR. J. W. PERKINS.

By H. P. Bowditch, M.D.,
PROFESSOR OF PHYSIOLOGY IN HARVARD UNIVERSITY.

In an article on "The Respiratory Function of the Human Larynx" in the *N. Y. Medical Journal* for July 4, 1885, Dr. F. H. Hooper recorded the observation that stimulation of the recurrent laryngeal nerves of dogs causes a dilatation of the glottis when the animals are thoroughly etherized, but a constriction when they are slightly or not at all under the influence of the drug. As the phenomenon occurred equally well whether the stimulation was applied to the intact nerve or to its peripheral end after section it was evident that the action of the drug must be either upon the peripheral portions of the nerve or upon the muscles.

In order to decide between these alternatives, and to ascertain whether similar observations could be made upon other groups of antagonistic muscles supplied by a single nerve trunk, experiments were undertaken by Mr. J. W. Perkins, interne at the Children's Hospital, Boston, in the autumn of 1885.

The sciatic nerve of the frog, with the groups of flexor and extensor muscles which it supplies, was selected for purposes of experiment. The frog was prepared by destroying the medulla and cord. The sciatic plexus was dissected out on both sides and shielded electrodes placed on the nerves close to their origin from the cord. The frog was then suspended in such a way that the hind legs hung freely in fluid contained in two beaker glasses, one leg being immersed in a 0.5 per cent. solution of common salt and the other in a similar solution to which three per cent. of sulphuric ether had been added.

Tetanic stimulation of the sciatic plexus was produced by a Du Bois Reymond induction apparatus having a secondary coil consisting of 10,260 turns of fine wire and graduated with arbitrary units of intensity such that the maximum stimulation, produced by pushing the secondary completely over the primary coil, corresponded to 1000 units of intensity.

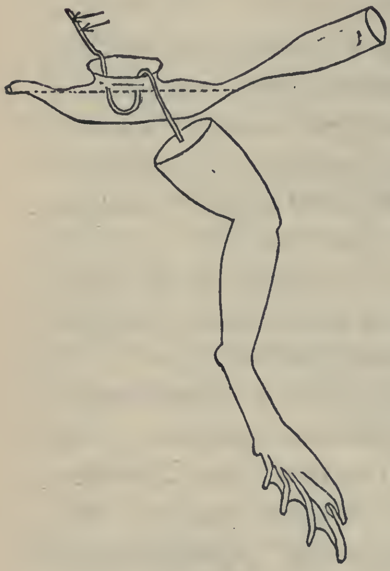
The experiment consisted in applying, at short intervals, a tetanic stimulation of very weak intensity ($I = 0.5 - 2$) to each sciatic plexus in turn and observing the position of the legs as one of them gradually came under the influence of the ether. It was observed that at the beginning of the experiment stimulation produced the same effect on both sides; viz., extension of the leg and abduction of the toes. After the ether had been applied five or ten minutes this effect gave place to a flexion of the leg and adduction of the toes, and after about twenty minutes the stimulation failed to produce any effect. Stimulation of the nerve on the side where the leg was immersed in the salt solution produced the same extension as in the beginning of the experiment. The solutions were now interchanged so that the etherized leg was suspended in the salt solution, and *vice versâ*. As the effect of the ether disappeared from the leg in the salt solution the stimulation of the nerve produced at first flexion and adduction which afterward gave place to extension and abduction as at first. This experiment was repeated with very constant results upon five different frogs.

It thus appears that there is a stage in ether narcosis when stimulation of the nerve, which ordinarily produces extension and abduction, causes the opposite effects and this action can be observed both when the narcosis is coming on and when it is passing off. For the sake of brevity, this action of ether will be termed the "ether effect." The phenomenon is apparently the same as that observed by Hooper on the larynx and, so far as the physiological action of ether is concerned, the constrictors of the larynx seem to correspond to the extensors, and the dilators of the larynx to the flexors of the leg, an analogy the reverse of that which was maintained by Rosenbach,[1] who was led to his conclusions by pathological considerations.

Since in these experiments the central nervous system was destroyed, it is obvious that this "ether effect" must be at the periphery, but whether upon the nerve trunks, the nerve terminations, or the muscular fibres cannot be decided from the above experiments.

To study this question the following experiment was performed. The sciatic nerve was freed from its connections for a distance sufficient to permit the portion of the nerve between the electrodes and the muscles to be immersed in a solution of ether. This was most readily effected by means of a bent glass tube, with a hole blown in the side, such as is represented in Fig. 1. The tube was bent or inclined at such an angle that fluid introduced by means of a pipette into the upper end would flow down and cover a loop of the nerve and could at the same time be readily washed away and replaced by another fluid introduced in the same way. Five experiments performed in this way gave results which were very constant and quite similar to those obtained when the ether was applied to the skin of the leg. The only important difference was that the action of the ether was much more prompt when applied directly to the nerve, complete paralysis taking place in about seven minutes. The "ether effect" manifested itself both in flexion and adduction and occasionally in peculiar twisting movements of the phalanges due to unequal stimulation of the various muscles. The important observation was also made that whenever flexion was obtained it could be converted into extension *by increasing the intensity* of the stimulation.

Fig. 1.



From these experiments we are justified in concluding that the "ether effect" is a phenomenon dependent upon the action of the drug upon the nerve fibres themselves, though, of course, the possibility of a simultaneous action upon the muscles is not excluded. An attempt was made to ascertain whether any such action of the drug upon the muscles really occurs by poisoning a frog with curare and applying electricity directly to the limb while immersed in a solution of ether.

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[1] Bresl. ärztl. Zeitschr., 1880, Nos. 2 and 3.

It was found, however, to be practically impossible to apply the electricity in such a way as to stimulate uniformly all the muscles of the limb and thus produce a movement comparable with that obtained when the muscles are stimulated through the nerve. The experiments made in this way were, therefore, inconclusive. It is evident, however, that the observed action of ether on the nerve trunks is sufficient to explain the "ether effect," and since, when one sufficient cause is demonstrated, it is illogical to assume the existence of another, we may conclude for the present that the phenomenon in question concerns exclusively the nerve fibres.

We must next inquire whether the ether can be supposed to exercise an elective action upon the fibres contained in the nerve trunk and to paralyze the fibres supplying the extensor and abductor muscles before it affects those which go to the flexor and adductor group, or whether some simpler and more probable explanation can be suggested.

The above-mentioned observation that flexion could be converted into extension by increasing the intensity of the stimulation, suggests the idea that the "ether effect" may be simply *partial paralysis* of the nerve fibres. On this hypothesis we should expect to find that stimulation of the nerve with a *very weak* current would cause flexion of the limb, even without the application of ether.

To test this question and also to study the effect of various other reagents besides ether upon the nerve trunk, a series of experiments on frogs were undertaken in the spring of 1886, by Dr. F. W. Ellis.

In these experiments the frog was prepared in the same way as by Perkins, but the position of the legs resulting from the stimulation of the nerve was recorded by means of photography. For this purpose the legs of the animal were suspended in water contained in a large cell with parallel plate glass sides. Behind the cell a piece of opaque white glass afforded a suitable background and in front was placed a dry plate camera by means of which the position of the legs could be photographed instantaneously. The drugs used were mixed with one-half per cent. solution of sodium chloride in distilled water and applied to the nerve in the manner above described.

The ordinary effect of an electrical stimulation of the sciatic nerve is well shown in Fig. 2.[1] Even with quite weak currents there is ordinarily marked extension of the knee, ankle, and toes, accompanied by strong abduction of the toes. In other words, the position of the leg is that assumed when the animal is just completing a vigorous stroke in swimming.

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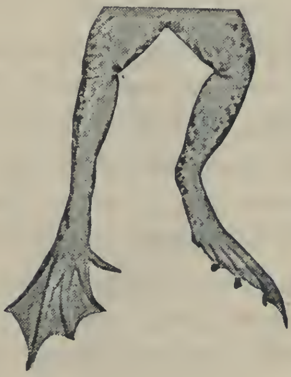
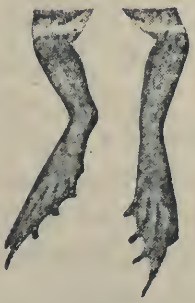
[1] This and the following figures are photoelectrotype reproductions of photographs taken in the manner above described. As the frogs were suspended with their ventral surface toward the camera the right leg of the animal appears on the left of the figure, and *vice versâ*.

Fig. 2.



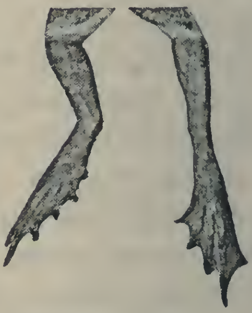
Effects of Ether.—In the experiments with ether, solutions of the drug varying in strength from one-half to five per cent., were employed. A three per cent. solution was most frequently used and gave, upon the whole, the best results. The observations of Perkins were in the main confirmed—*i. e.*, there was found to be a stage in the paralyzing action of the drug when stimulation of the nerve caused the leg to assume a position contrary to that occasioned by the same degree of simulation without ether. Instead of extension at the knee and ankle, there might be flexion; instead of extension and abduction of the toes, there might be flexion or adduction, or both. It was rare that all these contrary effects were manifested at once. There was generally a predominance of one, and frequently only one was manifested. These "ether effects" were obtained with some frogs more easily than with others, and were not always constant for the same frog. They were generally better obtained when the nerve was recovering from the effects of ether (*i. e.*, after removal of the ether solution from the tube and washing the nerve with saline solution) than when it was coming under the influence of the drug.

Fig. 3.



Ether on nerve.

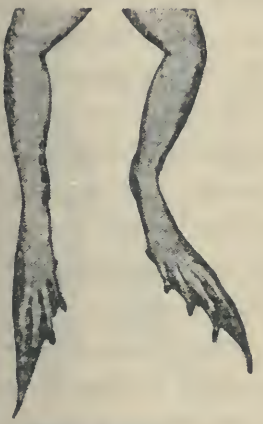
Fig. 4.



Ether removed.

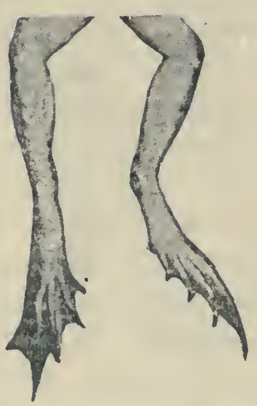
Figs. 3–8 illustrate these "ether effects." Fig. 3 shows the position assumed by the left leg on irritation of the sciatic nerve during the local application of ether. Fig. 4, the position assumed by the same leg after the removal of the ether. Here flexion and adduction under ether gave place to extension and abduction on removal of the drug. Figs. 5 and 6 show a similar "ether effect" on the right leg, but confined in this case to the muscles moving the toes.

FIG. 5.



Ether on nerve.

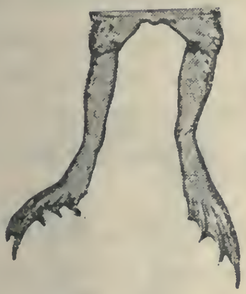
FIG. 6.



Ether removed.

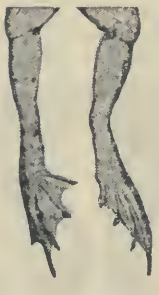
In Figs. 7 and 8 the "ether effect" manifests itself in a flexion of the foot and adduction of the toes combined with a strong extension of the leg.

FIG. 7.



Ether on nerve.

FIG. 8.



Ether removed.

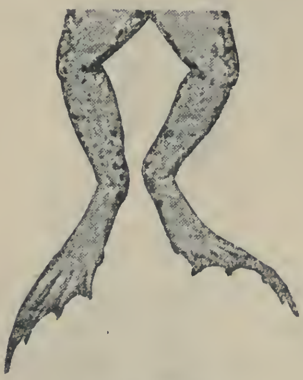
The local application of ether to the nerve was found not to affect the irritability of the nerve below the point of application. This was shown by experiments in which electrodes were placed upon the nerve, both above and below the ether tube. When powerful stimulation applied above the tube no longer caused contraction of the muscles, a very slight current applied below would produce the usual effect. The ether, therefore, seemed to produce a change in the nerve at the point of application, which rendered it incapable of transmitting the ordinary nerve impulse, complete paralysis resulting when the action of the drug was pushed to its extreme, and the so-called "ether effects" during intermediate stages.

Experiments with chloroform and alcohol showed that the "ether effects" could be obtained with these drugs also, although not so strikingly as with ether. A full discussion of the action of these and other drugs will be given on a future occasion.

It was also found, as had been previously observed by Perkins, that an increase in the intensity of the stimulation caused the "ether effect" to disappear, and the ordinary effect of nerve irritation (viz., extension and abduction) to take its place. This led to experiments on the effect of variation in the intensity of the stimulus, and particularly on the

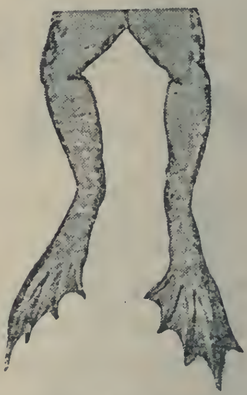
Effects of very Weak Currents.—The first experiments showing the effect of very weak stimulation were accidental. It was noticed occasionally, when the right sciatic plexus was very strongly stimulated in order to ascertain whether the application of ether to the nerve of that side had produced complete paralysis, that movements of flexion were produced in the leg of the opposite side. These were obviously due to the escape of electricity upon the left plexus, and it was observed that a still further increase in the intensity of the stimulus applied to the right plexus caused the ordinary movements of extension and abduction on the left side. It was subsequently found that by employing weak currents it was generally possible to cause movements (viz., flexion and adduction), which were ordinarily excited by very much stronger stimuli after the application of ether to the nerve. To produce these effects, it was necessary to use currents of very feeble intensity. These were best obtained by separating the secondary coil of the induction apparatus forty or fifty centimetres from the primary, and then turning it round a vertical axis. When flexion and adduction had been obtained in this way it was always possible to produce the ordinary movements of extension and abduction by increasing the intensity of the stimulation. Occasionally, as a result of very weak stimulation, twitchings or clonic contractions of the muscles were produced. These seemed to be due to a conflict between opposing sets of muscles.

Fig. 9.



Weak irritation.

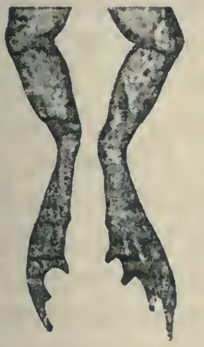
Fig. 10.



Strong irritation.

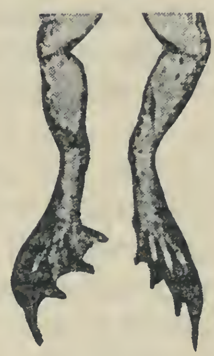
Figs. 9–13 illustrate the effects of variations in the intensity of the stimulation applied to unetherized nerves. Fig. 9 shows the position assumed by the left leg under the influence of a very feeble stimulus applied to the sciatic nerve of that side, and Fig. 10 the effect of a stronger stimulus applied to the same nerve.

FIG. 11.



Weak irritation.

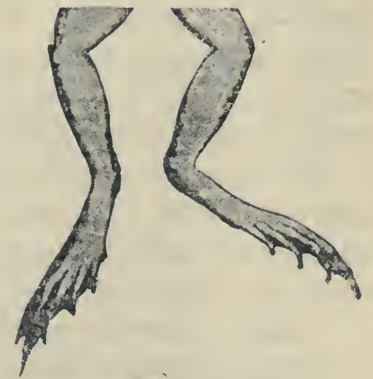
FIG. 12.



Strong irritation.

Figs. 11 and 12 show, in a similar manner, the effect of increasing the intensity of the stimulus applied to the right sciatic nerve. Fig. 13 shows the effect of a weak irritation of the left sciatic nerve, and by comparing the position of the left leg in this figure with that of the right leg in Fig. 2, a good idea can be obtained of the great variety of movement which can be produced by changes in the intensity of the stimulation.

FIG. 13.



Weak irritation.

These experiments by Ellis prove beyond a doubt that the effects observed by Perkins on stimulating a nerve immersed in a solution of ether, can be obtained with other drugs, and often with very weak currents without any drug. Without ether, flexion and adduction are to be obtained only with very feeble currents, but with ether much stronger stimulation produces the same effect. In both cases, however, an increase in the intensity of the stimulus causes these movements to give place to extension and abduction; the effect of the ether may, therefore, be said to consist in transferring the point, on the scale of intensity, at which the effect of nerve irritation changes from flexion and adduction to extension and abduction from the region of weak to that of relatively strong stimulation.

The "ether effect," as observed in the sciatic nerve of the frog, may be best explained by supposing that a partial paralysis of the nerve by the drug converts what would naturally be a strong into a weak irritation, and that this weak irritation affects only the flexor group of muscles because these are, for some reason or other, more irritable than their antagonists. A stronger irritation or a removal of the ether causes extension, since when both flexors and extensors are stimulated, the position of the leg is determined by the latter—*i. e.*, the more powerful group.

The question of the difference in irritability of the flexors and extensors of the frog's leg and the cause thereof has been much discussed. The fact that a feeble irritation of the sciatic causes flexion, and a strong irritation extension of the leg was first observed by Ritter in 1798, but the subject was first thoroughly investigated by Rollett in 1874–75.[1] This observer experimented with the amputated leg suspended in the air, and also with the muscles attached to myographic levers, and reached the conclusion that the cause of the greater irritability of the flexors was to be sought in the nerve fibres or in their mode of attachment to the muscles. Bour,[2] also, while criticising some of Rollett's methods, found that when the irritation was applied to the upper portion of the sciatic nerve, the flexors were called into action by a feebler stimulus than the extensors.[3]

There seems, therefore, to be no doubt that the flexor apparatus of the frog's leg responds to a feebler simulation than the extensor, but whether the cause of this difference lies in the nerve fibres, the muscle fibres, or in the mode of connection between the two, must be left for future investigations to determine. It is not impossible that the microscope may reveal histological differences between the different sorts of muscles similar to those described by Ranvier and others between the red and white muscles of the rabbit.

We must now inquire whether the above explanation of the "ether effect," as studied on the sciatic nerve of the frog, is applicable to the action of the drug, as observed by Hooper, on the recurrent laryngeal nerve of the dog.

A single observation upon a chloralized dog is reported by Hooper, in which a thread passed through the nerve and left in position for several days produced an effect analogous to that of ether on the sciatic nerve of the frog, viz., abduction of the vocal cord on irritation of the nerve on the side thus operated upon, while the same irritation on the opposite side produced the ordinary effect, viz., adduction. As all attempts to repeat this observation failed, no importance can be attached to it. On the other hand, it had never been observed in Hooper's experiments that feeble irritations caused a dilatation of the glottis, while stronger ones caused a constriction, but, as the effect of *very feeble* stimuli had not been specially studied, it was thought desirable, in view of the positive results obtained by Ellis on the frog, to make a few additional experiments directed to this particular point. Experiments were accordingly made upon chloralized dogs, with the result of showing that feeble irritations differed from strong ones in the extent but not in the character of the movements produced. Nothing resembling a dilatation of the glottis could be produced by diminishing the intensity of the stimulus.

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[1] Sitzungsberichte der Wiener Acad. Dritte Abth., lxx. S. 7; lxxi. S. 33; lxxii. S. 349.

[2] Verhandl. d. Phys. med. Gesells. in Würzburg. N. F. viii. 221.

[3] Dr. W. P. Lombard has kindly made a few experiments upon the irritability of the muscles moving the knee-joint of the frog, using for the purpose the delicate apparatus employed by him in studying the reflex actions of the frog (Archiv für Physiologie, 1885, p. 408). These experiments, though interesting in themselves, are not conclusive as to the relative irritability of the flexor and extensor groups of muscles. The evidence, however, seems to be slightly in favor of the above mentioned conclusion of Bour.

When this point had been reached in the study of the question, a paper entitled "The Function of the Recurrent Laryngeal Nerve," by F. Donaldson, Jr., B.A., M.D., appeared in *The American Journal of the Medical Sciences* for July, 1886. In this paper the writer gave an account of experiments on dogs similar to those made by Hooper, but leading to different results, for Donaldson, though unable to obtain the above described "ether effect," did observe a dilatation of the glottis when the recurrent nerve was irritated with *very weak* stimuli. This observation is, therefore, precisely in harmony with Ellis's results obtained upon frogs, and if confirmed would lead to the conclusion that the "ether effect" is in these cases also an effect of partial paralysis.

Shortly after the appearance of Donaldson's article a paper was read at the meeting of the British Medical Association in Brighton, entitled "On an Apparently Peripheral Differential Action of Ether upon the Laryngeal Muscles," by Felix Semon, M.D., F.R.C.P., and Victor Horsley, B.S., F.R.S. The authors were able to confirm the results of Hooper's experiments as to the effect of ether on the recurrent laryngeal nerve, and even gave a graphic representation of the "ether effect" studied by means of a rubber bulb inserted between the vocal cords. They explained Donaldson's failure to obtain the "ether effect" on the supposition that the animal was not sufficiently etherized. They also repeated Donaldson's experiments with currents of varying strength and obtained similar results in those cases in which the animal was not deeply under the influence of ether.

In view of these somewhat discordant results a renewed investigation of the effect of electrical irritation of the recurrent laryngeal nerve, with and without narcotics, seemed desirable, and Dr. Hooper is now engaged in a series of experiments which it is hoped will shed further light upon the subject.

The detailed results of these experiments will be published on some future occasion, but at the present time the following preliminary statement may be made.

It has not been found possible in these experiments to obtain a dilatation of the glottis by any stimulation of the recurrent laryngeal nerve unless the animal is under ether.

When the animal is etherized, the effect of irritating the nerve varies with the depth of the narcosis and the strength of the irritation.

If the animal is thoroughly under the influence of the drug dilatation of the glottis is produced by irritations of all intensities. In less profound etherization dilatation is still obtained with feeble irritation, but gives place to constriction when a stronger stimulus is applied.[1] As the effect of the ether passes off constriction occurs with feebler and feebler intensities until, finally, dilatation can no longer be obtained, and constriction is produced by irritation of all intensities.

The observation of Donaldson that dilatation is produced by feeble and constriction by strong stimuli is, therefore, correct *for a certain stage of etherization*, but for *unetherized* animals his statement has not been confirmed. The cases in which Donaldson has recorded a dilatation as a result of feeble stimulation are those in which the animal had been previously etherized, but was supposed to have recovered from the influence of the drug. In view of Hooper's failure to obtain dilatation on unetherized dogs, it seems probable that in Donaldson's cases the drug had not been completely eliminated.

It will thus be seen that, while the "ether effect," as shown on the sciatic nerve of the frog, may be explained as a partial paralysis of the nerve by the drug, the same explanation cannot be given of the phenomenon as manifested on the recurrent laryngeal nerve of the dog, for the action of ether cannot be imitated by feeble irritation of the nerves of unetherized animals.

The local action of ether, applied directly to the nerve, presents another point in which the two phenomena differ from each other, for the distinct "ether effects" obtained in this way by Perkins and Ellis on the frog's sciatic do not manifest themselves on the laryngeal nerve of the dog. A six per cent. solution of ether dropped upon the nerve of chloralized dogs, between the electrodes and the larynx, was found to gradually paralyze the nerve, so that stronger and stronger stimuli were needed to constrict the glottis, but a dilatation was, under these circumstances, never observed.

CONCLUSIONS.—The principal results of these various researches may be summarized as follows:

1. The ordinary effect of electrical stimulation of the recurrent laryngeal nerves of dogs is to cause constriction of the glottis, but if the animal is thoroughly etherized dilatation may be produced.

2. If the animal is partially etherized, the effect of the stimulation

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[1] It will be observed that this result is in harmony with the above-mentioned observations of Semon and Horsley.

will vary with the strength of the current, a weak irritation causing dilatation, and a stronger irritation causing constriction of the glottis.

3. The more complete the etherization the greater is the intensity of the current necessary to produce constriction.

4. A similar "ether effect" may be observed when the sciatic nerve of the frog is stimulated, the ordinary extension of the leg and abduction of the toes giving place, under the influence of this drug, to flexion and adduction. It is, however, always possible to produce the ordinary effects by increasing the intensity of the stimulation; and, on the other hand, it is possible, by using very feeble stimuli, to produce without etherization the same effects which occur on the application of stronger stimuli to animals under the influence of the drug.

5. This "ether effect" on frogs may be observed both when the ether solution is introduced by cutaneous absorption, and when it is applied locally to the nerve below the point of stimulation. Hence the most reasonable explanation of the phenomenon is that the drug, by diminishing the conducting power of the nerve, causes a strong irritation applied to the nerve to become a weak irritation when it reaches the muscles.

6. This explanation cannot be applied to the phenomenon as exhibited by the recurrent laryngeal nerve of the dog, for without ether feeble irritations do not produce dilatation, and, with complete etherization, strong stimuli do not produce constriction of the glottis.

COCAINE, AND ITS EMPLOYMENT IN OPHTHALMIC SURGERY.

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Since the invention of the ophthalmoscope in 1851, no discovery has been made which is likely to have so great an effect upon the progress of ophthalmic surgery as that of the anæsthetic effect of cocaine upon the eye. By doing away with the necessity of general anæsthesia, cocaine has robbed ophthalmic operations of their chief element of fear, so far as the patient is concerned, and has, at the same time, relieved the surgeon of a frequent cause of anxiety, both at the time of the operation and subsequently. As a consequence of this, not only have many operative proceedings and modes of treatment, which formerly were only occasionally resorted to on account of the pain or inconvenience attending them, become matters of daily practice, but an impetus has been given to the introduction of new modes of treatment, operative and otherwise.

In this respect the introduction of cocaine will have an effect upon ophthalmic surgery analogous to that which the introduction of general anæsthesia had upon general surgery, leading, as did the latter, to the substitution of frequent minor operations having a conservative tendency for the rarer and more radical ones. The introduction of anæsthetics, however, tended rather to discourage celerity in operating, while the employment of cocaine will have an opposite tendency.

It is early yet to see much effect in the direction of the introduction of new proceedings, the attention of the ophthalmic surgeon having been concentrated on discovering how its use affected those already well established. But already the signs of the coming change are visible. Paracentesis of the anterior chamber in iritis, the scraping away of old corneal opacities, the treatment of some forms of ulceration by the actual and potential cautery, and the cutting short of acute conjunctivitis by the application of strong astringents, are none of them new proceedings, but they were all of them sufficiently formidable to render their adoption exceptional, whereas they can now be employed in the ordinary routine of practice.

The alkaloid appears to have been first separated by Nieman[1] as long ago as 1859. Its physiological effects, when administered internally, were fully investigated by Hughes Bennett in 1873.[2] Its anæsthetic effect upon the mucous membrane of the tongue when applied locally had already been noticed by Schroff in 1862, in a communication which he made to the Medical Society of Vienna, but it does not seem to have occurred to anyone at that time that its anæsthetic properties could be turned to any account. The first suggestion to this effect appears to have been made by von Anrep, in 1880,[3] who experimented both by means of subcutaneous injection and by applications to the tongue. To Koller,[4] of Vienna, is, however, certainly due the credit of having first made definite experiments with the view of ascertaining whether the alkaloid had the same effect on the ocular as on the buccal mucous membrane. And it is to the result of these experiments that we are indebted for its introduction into practice.

The plant from which the alkaloid is obtained—the erythroxylon coca—is a native of South America, and there is a plentiful supply of the leaves, but the quantity which can be extracted from them is very small, being only one-fifth per cent. from the best. The following is said to be the best mode of separating the alkaloid:[5] Digest the leaves (the smallest being the best) within distilled water at a temperature of 60°–80° C., filter, and precipitate with acetate of lead. The excess of lead is removed with sulphate of soda and the filtrate is shaken up with ether. To clarify it water and hypochloric acid are added; it is then filtered, precipitated by carbonate of soda and crystallized out with hot alcohol. The alkaloid is soluble in alcohol, chloroform, and ether.

Cocaine was not appreciated in England quite as soon as in America;

this was partly due to the statements with regard to its anæsthetic effects having been received at first with some incredulity, and partly to the great difficulty which was at first experienced in obtaining a supply. Dr. Benson was one of the first to employ it, he having obtained some from America through a private source, but his first experiments do not seem to have impressed him very favorably for, in his first communication to the Ophthalmological Society,[6] he only hinted doubtfully that it might prove useful in some minor ophthalmic operations. Shortly afterward, however, it was freely used in all directions, and it was soon found that a discovery of the very first importance had been made.

We propose to consider: First, its physiological effect when applied to the eye. Second, its employment in ophthalmic surgery. Third, some occasional injurious effects.

PHYSIOLOGICAL EFFECT.[7]—(*a*) Applied to the eye it produces mydriasis, but this differs in several respects from that due to atropia.

The actual dilatation is often greater, although this is very variable, but the activity of the pupil to variations of light is retained. When as great a dilatation as possible has been produced by a single instillation of atropine, cocaine will increase it; the mydriasis from cocaine alone, on the other hand, is not increased by atropine. The excess of mydriasis produced by the cocaine is subject to the influence of light. By repeated instillations of atropine, however, a full mydriasis can be obtained which cannot be increased by cocaine.

The mydriatic effect, however, is extremely weak, for if equal proportions of eserine and cocaine be employed the mydriasis does not differ from that produced by eserine alone. In order that the two drugs should neutralize each other it is necessary that twenty-five parts of cocaine should be employed to one of eserine.

The mydriasis which follows paralysis of the third nerve is further increased by cocaine. When in rabbits the cervical sympathetic has been divided cocaine applied to the eye ceases to have any effect upon the pupil. In a patient of Jessop's who had all the symptoms of paralysis of the cervical sympathetic, repeated instillations of cocaine had no effect upon the pupil, but homatropine acted in the usual way.

When cocaine is applied to only one part of the cornea, the mydriasis is sometimes partial, affecting only the corresponding portion of the iris.

A drug may produce mydriasis by paralyzing the sphincter or the nerves supplying it, or by irritating the dilator fibres or their nerves. That cocaine does not act by paralyzing the sphincter or the branches of the third nerve which supply it, is evident from the retention of its contractility to light, and from the action of cocaine when the third nerve is paralyzed. It does not act directly upon the muscular fibres, or the sphincter, which is the stronger, would predominate. We are driven, therefore, to the conclusion that it acts upon the dilator fibres of the sympathetic, and its inactivity when the sympathetic has been divided is consistent with this.

Additional proof that the action on the iris occurs through the medium of the sympathetic is afforded by the results of Pflüger's experiments on birds.[27] In these the sympathetic nerve supplies the bloodvessels of the iris but not the dilator fibres, the latter receiving a special branch from the trigeminus. When the cervical sympathetic is divided above the superior cervical ganglion there is increased vascularity of the conjunctiva but no alteration in the pupil; and cocaine has no effect upon the pupil in birds, although it acts as an anæsthetic.

Cocaine mydriasis passes off in less than twenty-four hours. According to Jessop the dilatation of the pupil is very great and is quickly produced. According to the writer's experience, however, the action of cocaine varies very much in this respect in different individuals, and without corresponding variations in its anæsthetic effect. Occasionally he has seen complete anæsthesia produced with hardly any dilatation of the pupil; this, although exceptional, was not more so than full mydriasis.

(*b*) Another noticeable effect of cocaine is the widening of the palpebral fissure, this is due to retraction of both lids, but the effect is usually more marked in the upper. Jessop found that it still occurred if the orbicularis was paralyzed; it can, therefore, only be due to contraction of the involuntary fibre muscles of Müller, which are supplied by the sympathetic.

(*c*) Cocaine also causes contraction of bloodvessels, as might be expected from its action upon other sympathetic nerves: as the result of this there is often marked anæmia of the conjunctiva, and probably the great diminution in the amount of lachrymal secretion is due to the same cause. Upon vessels that are dilated from inflammation, however, it has little or no effect; probably this is because the power of the muscular coat of the bloodvessels is mechanically interfered with when the dilatation is excessive.

(*d*) The lowering of the intraocular tension, and the consequent flaccidity of the cornea which occurs in the cocainized eye is probably due to the contraction of the bloodvessels causing diminished intraocular secretion. There is reason to believe that at the same time the lymph spaces of the cornea contain less fluid, and its absorbent power is consequently increased; this will be referred to again in considering the occasionally injurious effect of cocaine.

(*e*) From a practical point of view the anæsthetic effect is, of course, the most important. There can be no doubt that it acts directly upon the nerve terminations, and is not due, as formerly supposed by Eversbusch,[8] to the contraction of the arterioles, and resulting anemia. This is evident from the following facts: its action is very local, it acts with equal efficacy upon vascular and non-vascular structures, its anæsthetic effect upon non-inflamed eyes does not vary with the anæmia produced, and the rapidity with which different structures are affected varies with the ease with which the cocaine reaches them. The sensibility of the conjunctiva and cornea are lost first, that of the iris not till the drug has reached the aqueous. As the result of numerous experiments in squint operations the writer has come to the conclusion that cocaine dropped upon the conjunctiva has little or no effect upon the sensibility of the muscles, but that it acts well and quickly if injected subconjunctivally.

Dr. Howe[9] has made some very ingenious and instructive experiments with the view of measuring and expressing numerically the anæsthesia produced. The basis of these is the well-known fact that the irritation of a sensory nerve causes a rise of blood-pressure throughout the body. A rabbit is taken and curarized to eliminate muscular contraction, which would otherwise influence the blood-pressure, and artificial respiration is carried on by means of a special apparatus, which insures its rhythmical performance, and whose effect upon the blood-pressure is a constant factor. A mercurial kymograph provided with a self-recording apparatus is then connected with the crural artery. A tracing is first taken to find the normal blood-pressure, which shows rhythmical variations corresponding to the heart's action. One eye having been cocainized, irritants of various kinds are applied successively to both, and the differences in the effect upon the blood-pressure noted.

The minimum dose required to produce any anæsthetic effect in the rabbit was a single drop of a 0.04 per cent. solution. The maximum effect of a 2 per cent. solution was attained on an average after a quarter of an hour and was as great as that of a 5 per cent. solution.

These experiments do not pretend to be exhaustive, but they open up a new field for investigating the action of cocaine; unfortunately this is forbidden ground to most in England.

The anæsthetic effect of cocaine upon eyes of which the deeper tissues are inflamed is very slight, probably this is in part because absorption in such is slow, and in part because there is hyperæsthesia. Often, however, it produces a marked effect in conjunctival inflammation when the photophobia is excessive as compared with the hyperæmia, the condition so often seen in the commencing catarrhal ophthalmia in young children. In such the writer has found that cocaine has immensely facilitated the examination of the eye.

Clinical Uses.—Incidentally several of the conditions under which cocaine can be utilized have been mentioned, and others can be inferred from what has been said. Broadly speaking, one may say that it will produce sufficient anæsthesia for any operation, when it can be brought into contact directly or by absorption with the parts implicated. The fact that the iris retains its sensibility longer than the cornea, has led to the suggestion that it should be injected into the anterior chamber either at the commencement of the operation, or after the corneal incision has been made. There are, however, obvious objections to this, and quite sufficient anæsthesia of the iris is produced by repeated instillation into the conjunctival sac. A local anæsthetic would be extremely useful for squint operations, since the retention of muscular contractility is of great assistance in guaging the effect produced. The writer has, however, found cocaine extremely uncertain in its action in these cases. When injected beneath the conjunctiva it acts well and promptly, but the chemosis which is produced is a decided inconvenience.

The use of cocaine, however, in ordinary ophthalmic operations is so general, and experience as to the immense advantages it possesses is so uniform, that it will be better to pass at once to the consideration of its employment in ways which are less generally practised, and to discuss in what direction practice is likely to be influenced by its introduction.

The treatment of ulcers of the cornea is likely to be modified in several respects. In the recurrent vascular ulcer, in which a single leash of vessels runs up to the ulcer the writer has found much good follow from the division of the vessels,—a proceeding which is not new, but one which could only be practised in exceptional cases when general anæsthesia was necessary. Mr. Carter's suggestion[10] also of treating some forms of ulcer by the application of nitrate of silver is an extremely valuable one if care be taken that the application is strictly localized. Cocaine renders this easy by preventing the reflex lachrymation, and at the same time putting the eye completely under control. Lately the writer in cases of pannus in which the vessels are not too numerous, has adopted the plan of obliterating the several vessels, but touching them just beyond the corneal margin with a very fine point of nitrate of silver, and has so far been well satisfied with the results. Paracentesis for pain in iritis is another instance of most successful practice, which has been rendered easy.

It remains to be seen how far the property which cocaine possesses of lowering tension can be utilized. Hitherto it has not been used in glaucoma except in conjunction with eserine; indeed, its mydriatic effect would probably counteract any beneficial effect that it might otherwise have, and as the eserine has always been used in quantities more than sufficient to counterbalance the merely mydriatic effect of the cocaine, it is impossible to say how much effect the cocaine had upon the tension.

In iritis the combination of cocaine and atropine has been extensively used, and, it is thought, with good results. Jessop has shown that these drugs together produce full mydriasis in the normal eye, more quickly than either of them alone. The dilating power of the cocaine is, however, so feeble that it is doubtful whether it can assist much in overcoming an adhesion.

In the cases of irritable conjunctiva in which there is excessive lachrymation of the eyes on exposure to cold, wind, etc., without any obvious cause to account for the symptoms, the writer has attempted to turn to account the power which cocaine possesses of diminishing secretion; but although the trouble diminishes while the cocaine is being used, he has not seen any permanent relief produced.

Injurious Effects.—That so potent a drug should occasionally produce injurious effects is no matter of surprise, and numerous instances have now been recorded in which cocaine applied to the eye, or injected, has been followed by local lesions, and by general toxic symptoms. Some of these are, no doubt, to be explained by impurities in the drug, an excessive and unnecessary concentration of the solution employed, and individual idiosyncrasies; deducting these, however, there still remains a residuum of cases in which cocaine undoubtedly produced bad local or general effects.

In almost the first case in which the writer used cocaine, the patient—a lad of fourteen—turned pale, and broke out in a profuse perspiration, a few minutes after the instillation of a single drop of a four per cent. solution, the pulse became very small and slow, and the lips bluish. Ammonia was administered and the patient made to lie down, but it was nearly an hour before he recovered from the condition of partial syncope. These symptoms might have been due to fright, but the patient did not show any signs of nervousness. In another case[11] the instillation of about fifteen drops of a two per cent. solution in a girl of twelve, was followed by severe pain in the head, dryness of the throat, marked malaise, tottering gait, and a difficulty in speaking as if the tongue were paralyzed. The symptoms lasted thirty hours.

The majority of the cases, however, have been elderly people, generally badly nourished. In three cases recorded by Bellarminoff,[12] vomiting persisted for several hours.

In the following case the repetition of the symptoms each time that the cocaine was used, leaves no room for doubt that they were really due to it.

In a woman,[13] aged seventy, with pulmonary emphysema, six to eight minims of a two per cent. solution were instilled, and cataract extraction performed; delirium came on which lasted for several days. A discission was performed eight days later for which three drops were instilled; great dyspnœa followed: this may, however, have been due to the previous condition of the lungs. On the following day six minims were instilled (for what purpose is not stated): dyspnœa, vomiting, and complete loss of appetite followed. Finally, cocaine was used for a needle operation on the other eye, when the same symptoms followed, although they were less severe since the dose was reduced.

When cocaine has been injected subcutaneously the symptoms have occasionally proved very alarming, as in the following case:

A woman, aged twenty-eight years,[14] strong and healthy, and not of a nervous temperament, applied to a dentist for the extraction of a tooth; he injected into the alveolus six minims of a twenty per cent. solution, and performed extraction without pain. About ten minutes after the injection the patient was noticed to have a staring appearance, and complained of dulness of vision. Soon she said that it was quite dark, and almost immediately fell back unconscious. When seen by Dr. Schubert, half an hour after the injection, she was lying in a dreamy state with the eyes half open, and could not be roused. The pulse was 80, full and strong. The arms were relaxed, the pupils of medium size, and active. There was no reflex movement on touching the conjunctiva or on pricking the face. Subcutaneous injection of ether produced no effect, but the inhalation of a drop of nitrite of amyl produced an immediate improvement. The patient now moved on being shaken, and answered at first at random, but soon rationally. Complete recovery soon followed, and she was able to go home an hour and a half after the injection. No after-effects followed. The ophthalmoscope was used as the patient was recovering, and the retinal arteries were thought to be somewhat smaller than at a subsequent examination.

Syncope[15] from failure of the heart's action also occurred in a case in which a ten per cent. solution was injected into the skin previous to opening an abscess.

The local troubles which have followed, and been attributed to the application of cocaine to the eye are of two distinct kinds—suppurative panophthalmitis and affections of the cornea.

Heuse[13] saw panophthalmitis follow the excision of a prolapsed iris with the application of the galvanocautery under cocaine, and Bell-Taylor,[16] Nettleship, and MacHardy[17] have reported series of cases in which suppuration has followed cataract operations in which it was employed. One must, however, be cautious of attributing these results to the cocaine. Cases of suppuration do occasionally occur in groups, and all recent investigations into the cause of suppuration in wounds of the eye tend to point to infection of the wound as the probable cause; this might be brought about through the medium of the atmosphere, instruments, etc., or by microörganisms introduced with the cocaine.

In some cases solutions, and in others disks were employed. Fungi often appear in the former when kept too long; while the latter very readily absorb moisture from the air. If, therefore, the suppuration was in any way connected with the cocaine, it was due, probably, not to any direct effect of the alkaloid, but to germ-infection.

We shall presently see that cocaine increases the absorbent power of the cornea, and in this way increases the probability of infection occurring, a fact which renders it doubly important to avoid operating with cocaine during the existence of any conjunctival catarrh.

Corneal lesions have occurred much more frequently, and there need not be the same hesitation in attributing them to the action of the cocaine, since they immediately follow its use, have been known to do so when the solutions used were free from bacteria, and are not known to occur under other conditions. These lesions are of two kinds, epithelial and interstitial, which may be associated, but are not necessarily so.

The first affects the surface of the cornea; this becomes slightly dull and rough, like the finest ground glass; and when touched with the finger, and sometimes spontaneously, the epithelium peels off. Sometimes this desquamation is preceded by vesication. Everbusch[8] was the first to describe this change; it occurred in a healthy young man, whose cornea was perfectly normal, and who was about to undergo an operation on the eyelids, and in a child of ten with squint. Bunge[18] describes four cases, all in elderly people, in which there was loss of the epithelium over a considerable area of the cornea; in none did any ill-effects follow. The writer has seen several such. One of these was a case of divergent squint, in a girl of eighteen. There was an old corneal opacity, but the eye was otherwise healthy. After the fifth instillation of a drop of a five per cent. solution of the hydrochlorate of cocaine, the conjunctiva below the cornea was seen to be slightly swollen; to present a very faint blush; at the same time the cornea looked dull and dry, as is seen in advanced glaucoma. On touching it with the finger the epithelium peeled off over an area of about three millimetres diameter. The operation was performed, and the next day the cornea had resumed its normal appearance.

Much more serious are lesions of the true corneal tissue. Pflüger[19] records the case of a man, aged sixty-seven, in whom he used a two per cent. solution for an iridotomy after cataract extraction. The wound healed well, but a week after the operation the cornea was still completely anæsthetic, T.—3, and there was ciliary injection. "Typical neuroparalytic keratitis" now came on, and vertical stripes of opacity appeared, deep in the cornea, looking as if they were caused by wrinkling of Descemet's membrane. The constant current was applied, and sensation returned after three applications. By the twentieth day the cornea had almost cleared. There was some anæsthesia of the other eye also, but this was attributed to tight bandaging. The length of time that elapsed before the corneal changes supervened, renders it possible that they were independent of the use of cocaine, but this objection cannot be urged against six cases reported by Bunge,[18] in which a parenchymatous opacity appeared, consisting of vertical stripes extending across the cornea from the wound.

Somewhat different from these cases are five cataract extractions reported by Dr. Wood-White.[20] He had frequently used cocaine, in combination with boracic acid as an antiseptic, but in these five cases he had substituted a solution of corrosive sublimate for the boracic acid. In all of these there was seen on the second day a pearly-white opacity of the cornea, which in one instance was sufficiently dense to conceal the pupil. The cornea cleared in all.

From the fact that such results have not followed the use of corrosive sublimate in the practice of others, nor that of cocaine in his own, Dr. White concludes that they were due to the simultaneous action of the two drugs, the cocaine in some way rendering the cornea more susceptible to the action of the sublimate. We shall see presently that this hypothesis has since received some confirmation. It should, however, be observed that Dr. White's cases stand on rather a different footing to those already quoted. The fact that the complication occurred in all his cases, while in the hands of others (some of whom certainly used cocaine and sublimate together) the complication is rare, suggests the suspicion that there was some peculiarity in the solutions used by him. The strength of the sublimate solution is not stated, nor is it stated whether the same was used alone in other cases. The opacity does not seem to have had the striated appearance described in the other cases, and cleared up more rapidly. It is, therefore, quite possible that the cocaine had nothing to do with the opacity, and that it would have appeared if the corrosive sublimate had been used alone.

As regards the cause of the vesication and desquamation of the corneal epithelium, Dr. White suggests that the corrosive sublimate may have something to do with this also; but this is certainly not so, for in the writer's case, and in some others, cocaine was used alone. Everbusch (loc. cit.) suggested that it might be due to the dryness of the cornea which the cocaine caused, by keeping the lids open, and thus favoring evaporation. Experimenting on dogs, he found that if the lids were kept closed between the instillations no desquamation took place, and states that since he has adopted this precaution in operations, he has seen no instances of this complication. Later experiments of Würdinger[21] have confirmed this. Into both eyes of a rabbit he instilled a drop of a five per cent. solution of cocaine at intervals of four minutes. The one eye was kept closed between the instillations, but not the other; no corneal changes occurred in the covered eye, in the other there was slight dulness of the cornea after three or four minutes, and twenty to twenty-five minutes after the first instillation the whole cornea presented a very fine roughness, then there appeared superficial depressions looking as if due to shedding of the epithelium, but the reflection from them was normal, and their floor showed no roughness. After the instillations had been continued for an hour, the cornea was so turbid that the condition of the iris could not be made out. To ascertain if these changes really depended upon dryness of the cornea, Würdinger next tried the effect of dropping distilled water, or lacrymal secretions, upon the cornea between the instillations of the cocaine. This did not remove the changes which had already appeared, but it prevented their increase.

The next experiments were directed toward ascertaining whether this dryness of the cornea was accompanied by a deficiency of lymph in its substance. For this purpose succinyl fluorescine was employed. One eye of an animal was cocainized, and, as soon as superficial changes had occurred, the fluorescine was instilled into both eyes. In the non-cocainized eye there was produced fluorescence of the superficial layers only, which was uniformly distributed. In the cocainized eye, on the contrary, deep fluorescence appeared first, and was there more dense; the superficial and deep areas of fluorescence then coalesced.

When the epithelium was abraded over a limited area on each cornea, and methyl-blue applied in the non-cocainized eye, it merely stained the abraded portion, while in the cocainized it spread thence over the whole cornea. These experiments seem to prove that cocaine increases the absorbent power of the lymph spaces of the cornea, and, therefore, probably diminishes the lymph in those spaces.

Microscopical examination showed that in the early stage the superficial depressions were due to thinning of the anterior lamellæ of the cornea, and that in a later stage the epithelium was absent.

The results of Würdinger's experiments on the combined effect of cocaine with antiseptic solutions were of still greater importance, for he found that solutions of borax, boracic acid, corrosive sublimate, and even of common salt, which were quite innocuous in the normal condition, caused, in the fully cocainized eye, a dense turbidity of the cornea identical with the striated keratitis occasionally seen after cataract extraction.

It is important that these experiments should be repeated and extended, for should they be confirmed, it is evident that a considerable modification of the methods of using antiseptics in operations on the eye may be necessary.

Corrosive sublimate has been used very freely of late as an antiseptic in operations in which cocaine was also employed, and corneal lesions have occurred but rarely; still this is not sufficient ground for acquitting the sublimate of having a share in their production. Further information is needed as to the concentration of the sublimate that is necessary to act efficiently as an antiseptic, and as to what is the strongest solution that can be used without danger to the cornea.

The published reports of many of the cases of corneal lesion following the use of cocaine, do not state whether corrosive sublimate was also used. Many of the cases, however, occurred in countries where the latter is used almost as a matter of routine, while in England, where antiseptics in ophthalmic operations are little used, Dr. White's cases, in which it was employed, are almost the only examples of interstitial changes in the cornea.

As to the form in which it is best to use cocaine, disks are certainly the best for experimental purposes, as the quantity introduced can thus be more accurately measured. For a time it seemed as if they would be the favorite medium for clinical purposes also. Mr. Nettleship's (loc. cit.) statement, however, as to the frequency with which he had seen suppuration follow their use, led to their being to some extent discredited, and their hygroscopic qualities would certainly seem an objectionable feature.

The aqueous solution of the hydrochlorate is most generally used. It has a tendency, however, to become turbid when kept, from the development of a fungus, and some of the ill effects which have occasionally followed its use have been thought to be due to this. Various means have been suggested for keeping the solution clear. Everbusch suggests the following: Take equal parts of a solution of corrosive sublimate (1 to 4000) and a saturated solution of salicylic acid, mix these, and use as a dissolving medium for the cocaine. Würdinger's experiments, however, show that this combination may prove injurious, and the safest plan, at present, is to use fresh aqueous solutions.

It seems now clearly established that little is gained by using strong solutions, and that as great an effect can be procured with a four per cent., or even a two per cent., solution as with a ten per cent., although more time is requisite to obtain the maximum effect.

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A REVIEW OF TWENTY-TWO COTTAGE CASES OCCURRING IN THE WOMAN'S HOSPITAL, IN THE SERVICE OF DR. T. GAILLARD THOMAS.

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It has been the custom at the Woman's Hospital for several years to perform operations in which the peritoneum is exposed, or in which aseptic surroundings are imperative, in a small detached building devoted exclusively to this purpose; and the term "cottage-patient" has become distinctive as regards a class of cases including laparotomies, removal of submucous fibroids filling the vagina, laparo-elytrotomy, etc.

The following cases are all the cottage operations that took place in Dr. Thomas's service while I was senior house-surgeon at that institution. They are of special interest to some of those who watched them, as no pains were spared to carry out antiseptic methods; nothing was taken for granted, and the smallest details were subjected to the personal supervision of the writer. No one who has not toiled with this subject, can appreciate the untiring vigilance that is necessary to secure the observance of antiseptic precautions. For the sake of dealing with the subject systematically and making clear the precautions exercised, four sources may be considered from which septic material can gain access to the wound.

1st. From persons concerned in the operation.
2d. From instruments, sponges, ligatures, and sutures.
3d. From spectators and the operating-room.
4th. From the patient's person.

Under the first head come the surgeon's assistants and nurses, the hands and forearms of the operator, and his perspiration.

The Toilet of the Operating Staff.—All taking part in the operation wash their arms and forearms carefully with soap and water, paring the nails and using a nail-brush. The hands are dipped into a solution of bichloride of mercury (1 : 2000) and a basin containing a solution of the same strength is within easy reach, so that the operator may cleanse his hand from time to time, particularly before introduction into the peritoneal cavity. When time permitted, it was the custom of the writer to take a bath shortly before the operation, and the hair of the head and face should always be thoroughly cleansed.

The nurse *must comply with the above-mentioned antiseptic precautions.*

Instruments.—All instruments are placed, for an hour before the operation, into 1 : 20 carbolic acid solution, to which an equal quantity of sterilized hot water is added when the instruments are in use. The water is taken from the tank of a high-pressure boiler, and carried to the operating-room in demijohns.

SPONGES.—The same sponges are used continuously, and to each is sewed a piece of tape, so that it is almost impossible to overlook them when closing the abdominal cavity. After an operation the sponges are carefully washed with soap and water and then boiled for several hours. They are preserved in a glass jar with an air-tight cover, and rest upon a false bottom composed of galvanized rubber which is perforated, and stands in a solution of carbolic acid, 1 : 20. Before use they are soaked for two hours in bichloride of mercury, 1 : 1000.

If a sponge becomes friable, or is difficult to clean, it is replaced, and a new one is prepared by soaking it in a very weak solution of hydrochloric acid for several weeks.

LIGATURES AND SUTURES.—Silver wire is rendered aseptic by immersion, with the instruments, in the solution of carbolic acid before an operation.

Of catgut, that prepared by Am. Emde was used. It is preserved in oil of juniper. No. 3 is the size most used, and Nos. 4 and 5 are at hand.

The silk for the pedicle and ligatures is prepared in the following manner: A piece of solid glass rod is bent in the form of a square, and on this the ligature is rolled, so that all parts are evenly exposed to the boiling solution of 1 : 2000 bichloride of mercury, in which it is suspended for an hour. It is removed from this solution under the spray (the utmost cleanliness as to the hands being observed) and dropped into a solution of carbolic acid 1 : 40. Under the solution it is reeled on a glass spool, and finally placed in a bottle containing 3 per cent. of carbolic acid in alcohol. The bottle, cork, and glass spool are boiled with the ligature. The end of the ligature is carried through the cork by means of a carrying thread attached to a round-pointed needle; all of these articles have been rendered aseptic.

When the ligatures are to be used, they are passed to the first assistant, who pulls a portion out of the bottle, cuts it off, throws it away, and then draws out the part intended to be used. By this method no one touches the ligature except the one applying it. When silk is used for sewing the abdominal wall, as many needles as there are stitches likely to be required should be threaded on the silk. By catching the last needle threaded, holding that fast to the end of the silk, and holding the remaining needles near the cork with the other hand, the annoyance of stopping to thread the needle is avoided. They are retained under an antiseptic solution.

Three varieties of silk are used. That for the pedicle is especially made for this purpose of loosely twisted strands, and is so strong that it cannot be broken with steady traction when used with a surgeon's knot about the pedicle. The smaller sizes are found useful to ligate vessels, and as sutures.

Spectators and the Room.—The walls, flooring, and everything in the operating-room should be rubbed with a cloth wet with the chloride of lime, 1 : 10, and the doors and windows thrown open for twenty-four hours, so that there may be the freest circulation of fresh air.[1] For an hour and a half two spray apparatuses saturated the air with a solution of carbolic acid 1 : 40. The solution used is about 1 : 20, but it loses about one-half of its strength by dilution with the steam. The spray is discontinued when the operation commences.

To guard against contamination from spectators, a rope is interposed, at least three feet from the wound.

Auto-infection.—The abdominal wall is shaved low enough to prevent the pubic hair from reaching the wound, and the abdomen washed with soap and water and covered with a towel wet with a solution of bichloride of mercury, 1 : 1000. This is removed just before the operator makes his first incision.

To prevent auto-infection from cysts containing septic material, the patient is turned on the side when they are evacuated. This procedure, which, I believe, originated at the Woman's Hospital, marks an important advance in the *technique* of operations for the removal of fluid tumors. If done properly, no undesirable fluid can escape into the abdominal cavity, and it is most expeditious. There is no trocar to get out of order and to be found unsuitable.

The cottages where these operations are done have been built for a number of years, and while they were an advance at the time of construction they are not in conformity with modern surgical architecture. They are small frame buildings, about 12 x 26, divided into two equal rooms by a square hallway and closet, between which is a passage connecting the two rooms. The hallway opens at the left side into the nurse's room, in which is a large stove by which the building is heated. There are no sewer connections with these buildings. The water is carried to them in pails and the slops removed by a similar method.

Before speaking of individual cases it would, perhaps, be better, in order to avoid repetition, to mention the routine methods—preparatory, operative, and after-treatment.

The patient's general condition is improved as much as possible, iron and a bitter tonic, and as much sunlight and fresh air as can be taken without causing fatigue. A vaseline bath is given every third night, and the bowels thoroughly evacuated, commencing the catharsis at least one week before the operation. The habits of the patient are taken into account as to the cathartic selected, but care is taken to avoid active catharsis two days prior to the operation, so that the patient may not be prostrated. The urine is always examined when the patient enters the hospital, and, if loaded with urates, an alkali largely diluted is used. Lithia water, or acetate of potassium (℥ss–Oj), to which is added iron if it be required, is found of service.

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[1] The cleansing of the room was not always as thoroughly done as it should have been owing to the exigencies of the hospital management.

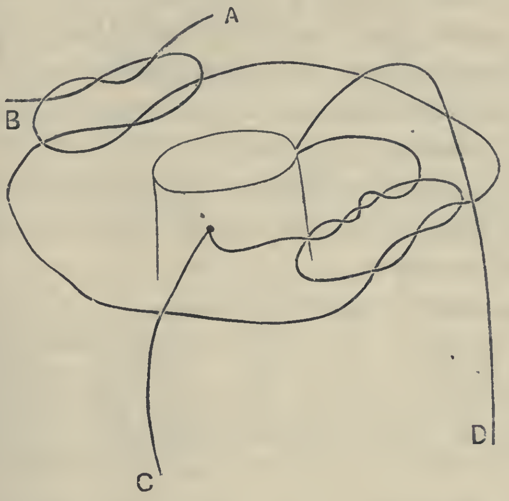
The patient is dressed with thick flannel drawers, stockings, and undershirt, and a blanket is pinned about the lower extremities. These are made to hang over the foot of the table by flexing the legs, and the feet are placed on a rest provided for that purpose. A towel wet with 1 : 20 carbolic acid rests on the blanket.

The operator stands to the right of the table facing his first assistant, on the other side of the patient. The second assistant stands a little back of the first, and between him and a table holding the submerged instruments, and has in his hands a tray with antiseptic fluid containing those instruments for immediate use. Two nurses stand to the left of the operator. One takes the dirty sponges and drops them into a six-gallon pail of hot water. After the blood and serum are washed out they are dropped into a similar pail containing a hot solution of bichloride of mercury, 1 : 4000. The second nurse holds them ready for use in a basin so that the operator can quickly change. If a sponge should fall to the floor it is not used again. A third assistant is responsible for the cautery iron, the Paquelin cautery, and electric light for the abdominal cavity.

Dr. Thomas's method of opening the abdominal cavity is as follows: An incision, three and a half or four inches (the tissues will contract so as to make the length about two inches), is quickly made to the *linea alba* or transversalis fascia. While the *linea alba* is the objective point, a slight variation to one side or the other is disregarded, and the cut continued directly through the muscle. The peritoneum is raised with a fine tenaculum, and snipped with scissors. A director is then introduced and the opening enlarged as desired. Hemorrhage has been checked by Péan's or Well's forceps before the peritoneum is incised. A digital or manual examination of the cavity can now be made. If a cyst is to be evacuated, the patient is turned on the right side, and after securing the sac with Nélaton's cyst forceps, an opening is made by the knife or scissors—a trocar may first be used. If there are endogenous cysts, these are broken up by the hand introduced into the opened cyst cavity. The abdominal cavity has been closed from the external air by sponges about the pedicle in the meantime, and the patient is again turned on her back.

In removal of the uterine appendages the patient is not turned on her side, unless gravity is desired to enable a pus-filled tube (or something of this nature), if accidentally broken, to drain itself on a sponge.

This diagram shows the method of securing the pedicle. The strands *A* and *B* are adjusted and need only be tightened to be secure. *C* and *D* are merely passed through the stump. They are tied in the same manner as *A* and *B*, with the exception that they pass about the upper half of the stump first. By this method each ligature passes once half and once wholly about the stump, so that it is entirely encircled thrice.



In closing the abdomen, three or four silver sutures pass completely through the abdominal wall, including peritoneum. The edges of the peritoneum are united by a continuous catgut suture, the muscles and fascia by the same thread, and finally, the skin is approximated more exactly by catgut than has been done by the silver sutures.

After sewing the abdominal wall together, the wound is covered with collodion, and before this dries well dusted over with iodoform; over this is placed a piece of iodoformized gauze, and then a number of narrow strips of adhesive plaster to give additional support in case the patient vomits, coughs, etc. This is covered by a roll of cotton batting, and the body encircled by a binder.

The After-treatment.—After the operation has been completed, the patient is placed in bed, where there are several water cans covered with flannel by the sides and at the feet. The room is darkened, and no one permitted near but the nurse, who is directed not to talk to the patient. If there is much pain it is controlled by compound solution of Magendie hypodermatically administered. A few small pieces of cracked ice may be held in the mouth, or two or three drops of lemon-juice to overcome nausea. I think that washing out of the stomach, immediately after the operation, in all these cases would prove most useful.

If the patient is in fair condition, no attempt to administer nourishment is made for twenty-four hours, and if quite strong, nothing is given for thirty-six hours. If by this time the gas has been passed freely, and there is no pain, a tablespoonful of milk or chicken-broth and lime-water is allowed every four hours, and an enema of beef peptonoid, half a drachm added to milk with a little liquor opii is given every four hours, alternating with the milk. Stimulants are used by the rectum, if indicated. No solid food is allowed until the sixth day. The pulse, temperature, and respiration, are taken every four hours, and if the nurse is skilful this can be accomplished without disturbing the patient. The temperature is taken in the vagina.

I wish to make my acknowledgment to Dr. Thomas Keith, of Edinburgh, for his kindness in communicating to me his practice in this important stage of these cases.

CASE I. *Commencing malignant disease of the uterus; removal of diseased tissue; recovery.*—Mrs. K., æt. forty-four; no children; last miscarriage twenty-seven years ago. Principal symptom has been a bloody discharge for six months, which has of late been very offensive. Dr. Thomas sent her to the hospital with the diagnosis of commencing malignant disease. Her general condition is excellent.

Sept. 26. Dr. Thomas drew down the cervix with a stout tenaculum, and removed a cone-shaped mass, including the diseased tissue, with a pair of sharp-pointed scissors slightly curved on the flat. The uterus was thus shelled out. On account of the hemorrhage it was necessary to apply two heavy silk ligatures at right angles, running up in the axis of the uterus, to draw together the bleeding surfaces. A number of smaller ligatures were used. Ligatures left hanging into vagina, and a tampon soaked with bichloride solution, 1 : 2000, used. This was removed on the third day, when there was a slight odor.

Oct. 14. All ligatures have come away. The discharge, which has been quite offensive, and required frequent douchings, has now markedly diminished. Patient sitting up.

25*th.* Patient left hospital.

Jan. 1886. Dr. Thomas heard from patient, who is feeling very well; no return of discharge.

CASE II. *Ovariotomy; recovery.*—Mrs. K., æt. twenty-three; no children; no miscarriages. About six months ago noticed general enlargement of abdomen. She has had no pain, but felt a dragging sensation in loins on assuming the erect posture. No other symptoms except vesical irritability and slight increase in monthly flow. Examination revealed a thin-walled cyst; fluctuation readily obtained, and equal in all directions. Uterus retroflexed and carried to the right.

Oct. 3. Dr. Thomas removed an ovarian tumor weighing 14½ pounds, in a little less than ten minutes. The left ovary presented several small cysts, which were punctured; also a small pedunculated fibroid, which was removed after its pedicle had been ligated. The ovary was then returned.

When the patient entered the hospital, at the right apex was heard high pitched and prolonged expiration, and the patient gave a history of cough for several months. In the second week after the operation, there were abundant râles at the right apex and free expectoration. The evening temperature would run as high as 103°, and the patient complained of severe sweats in the afternoon. Treatment: Fresh air, as much food as could be digested, stimulants, etc. The active process stopped finally, and March 1, 1886, she wrote that she was doing nicely.

CASE III. *Ovariotomy; death.*—Miss H., æt. fifty-one. Noticed general abdominal enlargement for one year—distinctive tumor appreciated two months ago. Principal symptom is pain on left side and inconvenience of tumor mass. General condition poor.

Oct. 17. Dr. Thomas removed an ovarian tumor from the right side. There were a few strong adhesions but no other complications.

21*st.* The patient died; the cause of death is unknown. The pulse had been very weak but not particularly rapid until the afternoon of this day, when the temperature ran up to 106° F., and the pulse to 130. She was comatose for a couple of hours before death. The autopsy showed much fat about the heart, but the fibrillæ were not affected. The patient had passed a fair amount of urine and it contained no albumen. There had been some oozing from the stump, not more than an ounce of odorless, fluid blood was found.

CASE IV. *Hegar's operation; recovery.*—Miss S., æt. thirty-two. Menstruation has been quite profuse, and the patient suffers greatly from abdominal pain. The symptoms arise from the weight caused by a large mural fibroid. She is a factory girl, dependent on her own exertions for a living.

Oct. 10. Dr. Thomas performed Hegar's operation, removing the ovaries without the tubes. The peritoneum was closed by continuous catgut suture; the pulse and temperature rose gradually after the operation, and emesis was continuous. On the second day after the operation the pulse was 138, temp. 102.5° F., resp. 14, and the patient was vomiting incessantly. On the fourth day the temp. was 105° F., and pulse 152. On the morning of the fifth day the abdomen was reopened, but nothing found. From this time the patient made a good recovery. A mural abscess developed a few days after the abdominal cavity had been reopened, but no local tenderness at that time existed, although it was carefully sought for.

August, 1886. Examination by the writer showed that the mass was smaller, but nodules could now be detected that were not before apparent. Patient says she has very much less disturbance, and is sure the mass is much smaller. The nodules that are now apparent were probably present before the operation, but atrophy in some portions of the tumor has changed its position.

CASE V. *Removal of the ovaries and tubes; recovery.*—Miss H., æt. twenty-four. Has suffered intensely at her menstrual periods for years. She was under treatment for a long time at her home in the West, and as a last resort was sent to New York City. The ovaries were enlarged, tender, and prolapsed.

Oct. 10. Dr. Thomas removed the ovaries and tubes. The patient made a good recovery; there was no complication. June 2, 1886, she writes: "I can endure a great deal of exercise with very little fatigue, and feel better than ever before in my life."

CASE VI. *Ovariotomy; recovery.*—Mrs. D., æt. thirty-four; seven children. One miscarriage three years ago. Two years ago her abdomen commenced to enlarge, and she has lost a great deal of flesh in the past seven months. Suffers from pain in the side for the past six weeks. Examination made evident the signs of a simple cyst.

Nov. 21. Dr. Thomas removed a large ovarian tumor from the left side. There was a varicose condition of the veins of the broad ligament, some being as large as one's thumb. The right ovary was normal. Time of operation twelve minutes. There were no after-complications.

I heard from the patient several months after the operation and she was doing bravely.

Case VII. *Removal of fibroid; recovery.*—Mrs. W., æt. forty-three; no children; no miscarriages. Has flowed excessively for a year. Was in the hospital five months previously, and Dr. Thomas diagnosticated a large fibro-myoma of the uterus of the submucous variety. He thought it was best to wait at that time, and in the meanwhile to have the patient carefully watched. He thought that by delaying, the pedunculation would be more fully accomplished. When she presented herself at the hospital the second time, she was so weak and anæmic that a fainting fit would follow an attempt to assume an upright posture. The fibroid filled the vagina, and from pressure, and poor nutrition, it had commenced to slough on its external surface. Her principal symptoms at this time were vesical irritability and dragging pains. She had had morphine for the past two weeks.

Oct. 28. Dr. Thomas removed the mass by the vagina piecemeal, with a very powerful pair of scissors; at times cutting with the greatest care, and at others removing boldly pieces as large as half a kidney. The mass altogether weighed a little less than three pounds, when the blood had drained away. The patient was very weak, and the hemorrhage was controlled by steady traction on the uterus with a stout tenaculum, held by the writer.

February 25, 1886, this patient writes: "I am gaining strength and flesh very rapidly."

Case VIII. *Removal of fibroid*; *recovery.*—Mrs. K.; laparotomy and removal of a fibroid tumor and drawing up the vaginal wall to cure a vaginal hernia. This case is reported in full by Dr. Thomas in a paper read before the Academy of Medicine, December, 1885, and published in the New York *Medical Journal*, December 26th of the same year.

Case IX. *Removal of dermoid cyst of ovary; recovery.*—Miss McC., æt. twenty-six; has suffered more or less pain for months. Has had slight vesical irritability for years. Examination shows a large mass wedged in the pelvis. The uterus is thrown forward and crowded up against the symphysis pubes, and measures four and a half inches in depth. The mass felt so hard, that the writer thought it was a fibroid of the posterior wall of the uterus.

Nov. 9. Dr. Thomas removed a dermoid cyst of the left ovary. The contents consisted of reddish hair, several imperfect teeth, and a large mass of fatty fluid. The right ovary and tube removed on account of cystic degeneration in the ovary.

Complications: A large mural abscess; otherwise made a good recovery. Have heard of the patient through others within the past five months, and she is doing well.

Case X. *Ovariotomy; recovery.*—Mrs. F., æt. thirty-four. Two children, youngest twelve years of age. She has suffered from digestive derangements and bearing-down pains for about a year, and for the same time has noticed two lumps in the abdomen side by side. Examination revealed two dense cysts connected to the uterus and each other.

Nov. 9. Dr. Thomas made the usual incision. There were dense adhesions in all directions, and after working to the side, a slate-colored cyst wall presented. The cyst was evacuated in the usual manner. The adhesions to the small intestine were very numerous. These were broken up as gently as possible by the sponge and the fingers, and the cyst removed. Below the position of the cyst, and to the right, was discovered a smaller papillomatous mass about the size of an orange. After much difficulty, on account of hemorrhage, this was removed. It proved to be the right ovary. A large number of silk ligatures were left in the abdominal cavity, and a long glass draïnage tube was used.

On the seventh night the tract of the drainage tube was washed out carefully, and, afterward, twice daily, as the discharge was quite large in amount, and rapidly became offensive when not thoroughly cleaned. The temperature could be maintained nearly normal by this means.

This patient has been under my care since the operation, on account of a fistulous tract that has not yet entirely closed. This is probably due to a ligature, and as it gives her very little inconvenience, I have advised her to wait patiently until it comes away. I am the more inclined to give this advice, as I have known of a somewhat similar case where death followed operative interference.

Case XI. *Ovariotomy; recovery.*—Mrs B., æt. fifty-one, no children, five miscarriages; the last, five years ago. Menstrual flux normal. She was tapped five months ago for dropsy, but the relief was of short duration. First noticed increase in size one year ago. The principal symptoms are great emaciation, and discomfort from the presence of a large cyst.

Nov. 4. Dr. Thomas removed a large ovarian cyst; there were no adhesions, and the patient made a good recovery. The temperature was never above 100° F. I heard from the patient nine months after the operation, and she felt very well.

Case XII. *Abdominal abscess; laparotomy; recovery.*—Mrs. K., æt. twenty-three; no children; suffering from hectic for past six months. Abdominal cyst discovered. It was thought to be an abscess.

Nov. 21. Dr. Thomas made the usual incision. When the peritoneum was reached everything was found matted together. On opening the abdominal cavity, a slight tear made an opening, through which welled up stinking pus. Dr Thomas seized the sac with a tenaculum, and held it so that not a drop escaped into the abdominal cavity. There was over a quart of this offensive purulent fluid. The wound was washed out with a solution of mercuric chloride, 1 : 4000, and the wound closed after the sac was securely fastened to the abdominal wall. A long glass drainage tube was left projecting from the sac. The cavity had been closng up so nicely from the bottom, that when she left the hospital a two and a half inch tube was substituted for the original one of six inches.

The sac was kept clean by repeated antiseptic douches. The temperature was taken every four hours, and if above 100° F. the interval between the washings was diminished. It was done on some days every second hour. The discharge continued sweet after the first few washings. The patient had been much run down before the operation, but improved so much afterward that she became impatient because of the restraints of the hospital, and took "French leave."

Case XIII. *Removal of uterine appendages; recovery.*—Miss M., æt. thirty-three. She has suffered from pain in her left side, particularly at the menstrual periods, until life has become a burden. She is a schoolteacher, dependent on a salary for her maintenance, but is unable to do any work at the time of her periods. She has undergone varied treatment from many physicians, but with no benefit. The uterus, which is retroflexed, was at one time replaced forcibly, while the patient was etherized, but, as might have been expected, she was not relieved.

Nov. 25. Dr. F. P. Chambers removed both ovaries and tubes. No complications except that a small cyst ruptured in removing the right ovary, but the fluid was clear.

In this case the ovaries and tubes were as healthy as many women have who probably never have a symptom of pelvic trouble. I have removed much worse specimens after death, where there was no history of any symptoms referable to this pathological condition, yet no one who was well acquainted with the facts in this case, could have doubted the indications for this operation, judging entirely from the results.

I quote from a note received from this patient December 4, 1886: "I received your note this week, and am very happy to say I feel perfectly well. My head troubled me at first very much but it is constantly improving, and does not trouble me more than once a day (month?). I was unwell but twice, that being the two successive months after the operation. It took a long time to regain my strength, but I can say now that I never felt stronger or better. I have gained about twenty pounds."

Case XIV. *Ovariotomy; recovery.*—Miss S., æt. twenty-six, for four months has noticed her abdomen increasing in size. The principal symptoms are due to inconvenience caused by the size of the mass.

Nov. 28. Dr. Thomas removed a twenty-two pound tumor of the right ovary. There had been suppuration in the cyst. The left ovary, which was enlarged and cystic, was removed with the tube. No complications. The patient made a good recovery.

Case XV. *Removal of parovarian cyst; recovery.*—Miss R., æt. twenty-two. For four years her abdomen has steadily increased in size, most noticeably on the right side. The increase has been much more rapid for the past few months. Principal symptoms: nausea and shortness of breath. This patient came alone from Cuba. She was unable to speak a word of English, and I cannot refrain from a passing tribute to the courage that enabled her to come among strangers and undergo so serious an operation.

The patient had a severe chill after the operation, and her temperature ran up to 103° F. This readily responded to quinine; otherwise the case was uneventful.

Case XVI. *Removal of ovarian cyst from right side, and of uterine appendages from the left; recovery.*—Mrs. H., æt. twenty-nine; no children, and no miscarriages. Well until one year ago, when her abdomen began to increase in size. The growth has been more rapid lately. It has seemed stationary for the past two months. Principal symptoms: inconvenience of locomotion and dyspnœa.

Dec. 5. Dr. Thomas removed an ovarian cyst from the right side. The pedicle was about eight inches in length and very thin. The left tube was enlarged and, with the ovary, bound down. From it stood out a gelatinous mass about as large as a thimble; this was broken in removing it. The ovary and the tube both removed. The temperature went up the first few days to 102.3° F., otherwise there was no complication. The patient was heard from nine months after the operation and was doing well.

Case XVII. *Removal of uterine appendages; recovery.*—Mrs. B., æt. twenty-eight. Since the birth of her last child two years ago, she has suffered very much at her periods and at other times. She has a marked anteflexion, but the uterus easily admits a large sized probe. She has been under treatment for two months in the hospital and for a long time outside of this institution.

Nov. 23. Dr Thomas removed both ovaries and tubes. The tubes and ovaries on both sides were bound down by strong adhesions. The usual three layers of sutures used, but they were all of catgut. There were no complications. I heard from this patient a few months after the operation, but she felt no better, and thought she was somewhat worse.

CASE XVIII. *Removal of uterine appendages; recovery.*—Mrs. G., æt. twenty-two; no children; no miscarriages. This patient suffered for eleven years from dysmenorrhœa. She has been under treatment for more than two years. An ovary found prolapsed, and much inflammatory action about it. She has been in the hospital, and under observation for four months.

Jan. 2. Dr. Thomas made the usual incision, and found the tubes largely dilated and full of blood; these, with the ovaries, removed; she made a good recovery; no complications. I heard from her seven months after the operation; feeling very well, except for vesical irritability, which troubled her previous to the operation.

CASE XIX. *Removal of uterine appendages; recovery.*—Miss L., æt. twenty-three; has never menstruated; at periods of about twenty-eight days she has suffered from bearing-down pains. She was sent to the hospital for operation with the diagnosis of hæmatometra. It was ascertained that this diagnosis was incorrect, and it proved to be a case of undersized uterus and enlarged ovaries and tubes. She was sent away from the hospital, the dangers of the operation being strongly presented to her mind. In a few months she returned, saying she did not care to live and suffer as she was doing. She was a school-teacher.

Dec. 23. Dr. Thomas removed the tubes, which were dilated as large as small lemons, and full of clotted blood. The ovaries were the size of horse-chestnut burrs, and also filled with coagulated blood; they were also removed. There were no complications, and the patient made a good recovery. I heard from her some time since the operation, and she is doing well.

CASE XX. *Removal of ovarian cyst from left side, and of appendages from the right; recovery.*—Mrs. G., æt. twenty-eight; never pregnant. Her principal symptoms are, increase in size of the abdomen, which she has noticed for the past four months. She has also suffered from abdominal pain.

Jan. 16. Dr. Thomas removed an ovarian cyst of the left side. The right ovary was found cystic, and was also removed, with its tube. The operation was complicated by a band of tissue between the abdomen and the cyst. This was tied with silk, and divided. The highest temperature was 100.4° F. The patient left the hospital well. She has not been heard from since.

CASE XXI. *Removal of uterine appendages; recovery.*—Mrs. S., æt. twenty-seven; never pregnant; suffers from pain in her abdomen. Has had pelvic peritonitis several times.

Jan. 16. Dr. Thomas removed both ovaries and tubes. The left tube was much enlarged and filled with pus; both tube and ovary bound down by very strong adhesions. The tube was ruptured in removing it, and part of its contents escaped into the abdominal cavity. Right ovary and tube firmly bound down. The tube was enlarged. The patient made a fair recovery from the operation.

Jan. 16, 1887. Mrs. S. writes: "I have felt very well, and have not needed any medical treatment."

CASE XXII. *Removal of uterine appendages; recovery.*—Mrs. M., æt. thirty-five; three children; the last child was still-born, three years ago; has had *grand mal* for three years. The periods between these attacks have grown less, and now appear every two weeks. Examination shows an enlarged and very tender ovary on the right side.

Jan. 23. Dr. Thomas removed ovaries and tubes. There were no complications, and the patient made a good recovery. She left the hospital in the middle of February.

THE STATION OF MAN, CONSIDERED PHYSIOLOGICALLY AND CLINICALLY.

BY GUY HINSDALE, M.D.,
OF PHILADELPHIA.

IN forming an opinion of a man's physical condition it is desirable to observe not only his gait, but also his power of preserving an erect position while standing—which we technically call station. Even before any question may be asked, the physician can form an approximately correct opinion of the disease as the patient walks into his office, and stands before him.

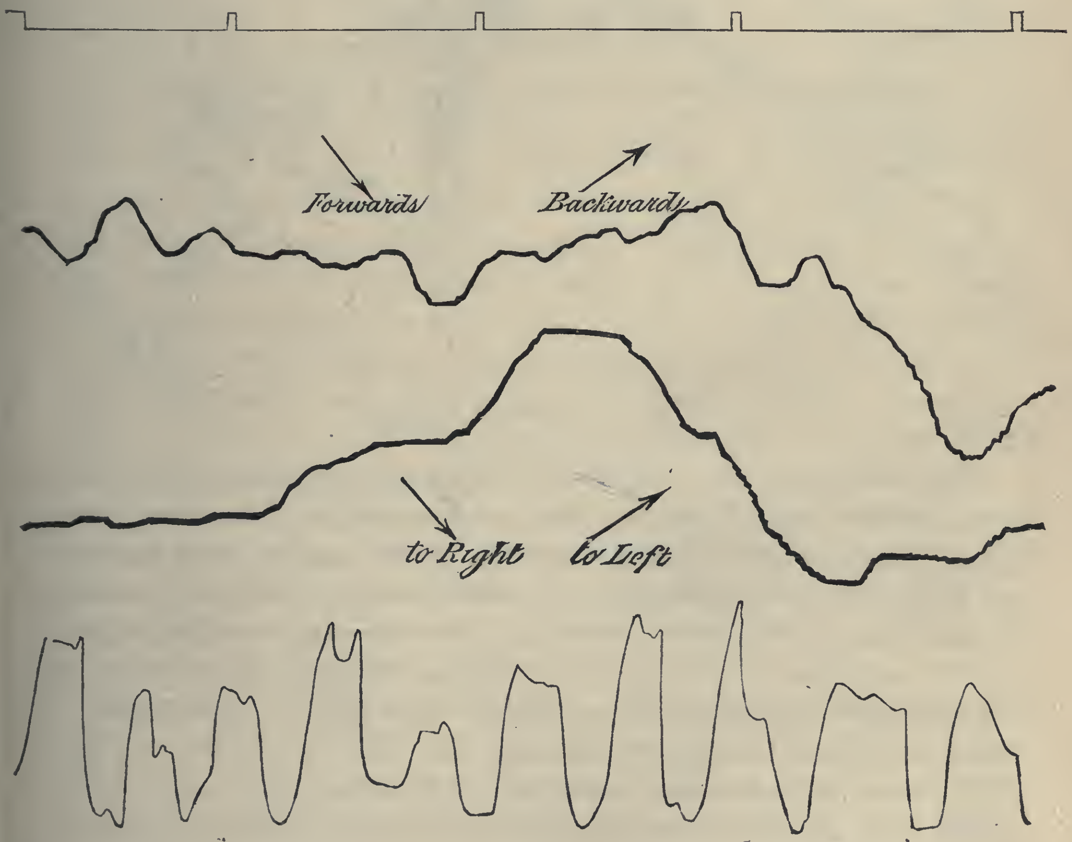
For some time past Dr. Weir Mitchell's attention has been directed toward bringing to an arithmetical precision of statement certain symptoms which we are usually obliged to record with more vagueness of statement than is desirable. One of the most important of these inquiries has been as regards station. For this purpose, Dr. Mitchell suggested and used a simple form of apparatus, already described in a paper by Dr. Morris J. Lewis and himself. At this point, at his request, I took up this study.

In order to do this accurately, it was necessary to construct certain apparatus so that the disturbances of equilibrium might be recorded. This was done with the assistance of Prof. Reichert, in the Physiological Laboratory of the University of Pennsylvania.

To observe the sway of a healthy man, the subject was made to stand with his heels and toes together; his hands were allowed to hang by the side; the head was held erect, the eyes being directed at a fixed object. A record of motions in the antero-posterior line was made by attaching a silk thread to a fillet over the forehead; the thread passed over a pulley, and was connected with a rod moving vertically, and carrying an index. This index marked a smoked paper attached to a drum, which revolved laterally by means of clockwork. A downward movement of the index and a fall of the line scratched on the smoked paper, indicated a forward movement of the head; and an upward line recorded the backward movement.

In like manner the lateral movement was recorded. A silk thread was attached to the side of the head, and was carried at right angles to the forward and backward line, for a few feet, and thence by a pulley so as to move a needle and index at the side of the one recording antero-posterior movement, upon the same blackened surface. The sway for the two directions was thus resolved into upward and downward movements on the same paper. By means of a tube connecting the mouth with a diaphragm which moved a lever and index, the respirations were also, in some instances, recorded. Seconds were marked on the paper by means of clockwork and an electric index. Such a tracing is shown in the accompanying engraving.

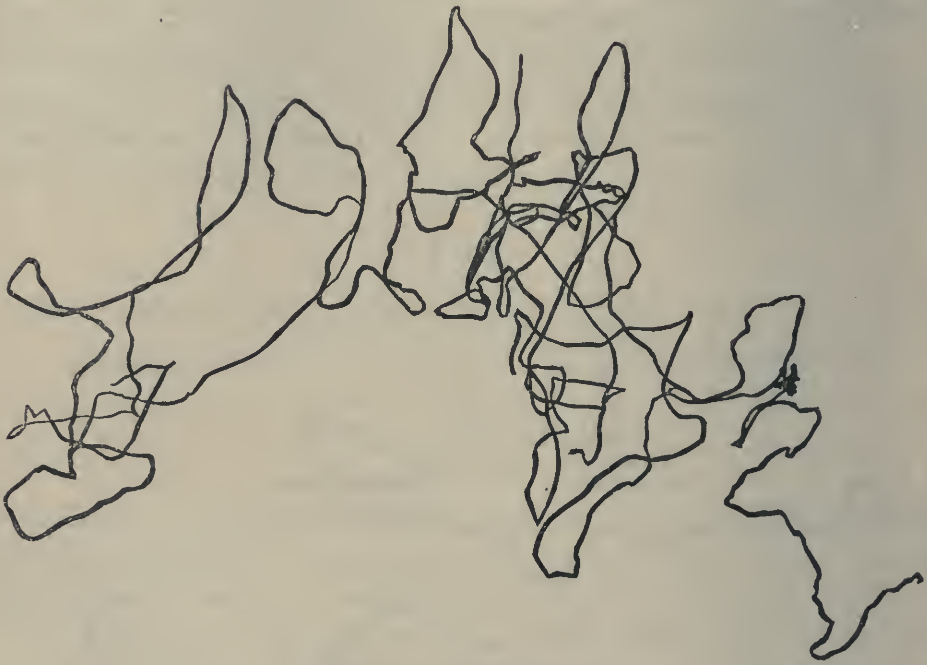
Fig. 1.



a, five second spaces.
b, movement antero-posteriorly.
c, movement laterally.
d, respiration curve.

Other tracings were taken by attaching to the top of a man's head a flat piece of cardboard, upon which was stretched some smoked paper. The subject was then placed under an index, free to move up and down, in a fixed line, and which traced curves on the paper as the subject who stood beneath swayed in any direction. This is the clinical method in practical use at the Infirmary for Nervous Diseases. A tracing from a case of locomotor ataxia is here shown.

Fig. 2.



Sway of a locomotor ataxic.

Other measurements were taken by placing the subject in front of a scale graduated in inches, and noticing the amount and direction of sway, the observer being seated about ten feet distant, and the head steadied; one eye being used in making the observation. When this has been done in front of the subject, the latter is then placed at a right angle to the first position, so that the antero-posterior sway may be recorded; or two observers may make these records simultaneously. The subject in no case is allowed to touch anything; the heels and toes are placed together, and he is not told the object of the inquiry.

This is the coarser method in practical use at Dr. Mitchell's clinic.

It was, of course, found that no man could stand absolutely still; the body swayed forward and backward, and from side to side, in every instance. The sway in the antero-posterior line was found to be greater, as a rule, than the lateral sway; the antero-posterior ranged in health from one-third to one and a half inches; the lateral sway from a quarter to an inch and a half. On closing the eyes, the sway was decidedly increased. This increase shows to how great an extent we use our eyes in correcting these oscillations. When we shut our eyes we cease, to a large degree, to correct these differences.

The first movement is almost invariably forward, then there is a counterbalancing effort, bringing the body backward, and usually to the right. The more pronounced sway is in the antero-posterior line, as may be seen in the tracings; as resultants of these, and of lateral sway, there are minor curves.

Clinically, certain abbreviations may be used in the records of cases, as follows: A. D. (antero-dextral). A. S. (antero-sinistral). P. D. (postero-dextral). P. S. (postero-sinistral). A. 1 D. ¾, would mean that the subject swayed forward one inch, and to the right three-fourths of an inch. This we have found to be the average for normal adults.

The records showed a law of irregular rhythmical motion. This was noticeable chiefly in the forward and backward movement, but these waves of motion did not correspond with respiration as a whole or fractionally.

Respirations per minute were recorded as follows: 21.5, 23, 20–21, 23, 31, 28, 29, 22, etc. In one observation, extending over three minutes, the subject, a healthy Irishman, employed in the physiological laboratory of the University of Pennsylvania, respired in the first minute 27 times, in the next minute 28 times, and in the third minute 26½ times. The tracing, as usual, showed certain waves of antero-posterior motion; of these there were during each of the first three minutes, 12, 11, and 11 respectively. In another instance, in the same individual, the respiration was 22, and the antero-posterior waves 14. In the writer's case, 13 of these waves and 24 respirations were recorded in one minute. Thus the normal man has a rhythmical sway of about 14 to the minute. What governs this as to number is not clear.

A very large percentage of the normal individuals observed seemed inclined when losing their equilibrium to fall forward and then slightly to the right. The motion is greatest in the forward and backward line. The subject, as a rule, does not go so far backward as forward and not so far to the left as to the right.

We have endeavored to ascertain whether the sway to the right or to the left may be coincident with right-handedness or left-handedness. While right-handed people almost invariably are inclined to tilt over to the right, of 22 left-handed people 12 were inclined to tilt to the left.

This at once opens the whole subject of asymmetry. That the right side of the body, as a whole, is usually larger than the left, in persons who are right-handed, is generally accepted. The difference is noticeable in the shoulders and upper extremities. The right arm displaces several more cubic inches of water when immersed in a tube up to a given point, and is stronger than the left.

The weight of the arms being unequal the centre of gravity is, therefore, slightly on the right side; and it has been found that a man who has lost an arm sways to the sound side. "The weight of the arms is so important in correcting the oscillations of the centre of gravity in walking, that if one be lost a runner needs another of the same weight."[1]

The careful weighing of the muscles of the legs and of the back, excised from the body, has shown the right to be in excess.

The cause of this excess is doubtless finally to be referred to the central nervous system. The left cerebral hemisphere, from its slightly greater size, especially in the motor area, and greater density, has been termed the "leading side."

In connection with this it is interesting to state that Flechsig found the decussation of fibres in the anterior pyramid unsymmetrical, more crossing from the left brain to the right of the cord than in the opposite direction. It may, therefore, be that decussation of the motor fibres renders the right side of the body, from a muscular standpoint, the leading side. But Flechsig also found that nearly all the fibres decussated in some instances, forming the posterior column of the lateral opposite half of the spinal cord; however, in rare cases, almost none of the fibres decussated. It would be interesting to determine whether, in these cases, the subjects were or were not left-handed.

As an antithesis to this, M. Bourdon's observation is noteworthy. In the case of a man who forty years previously suffered a disarticulation of the *left arm*, the *right brain* showed a decided depression of the ascending frontal convolution, the paracentral lobule and the convexity of the right hemisphere; there was also enlargement of the right lateral ventricle, due to very extensive atrophy of adjacent white substance. The *right brain* weighed thirty-one grammes less than the left.[2]

The point I wish to make clear is that cerebral development and activity have a direct relation to muscular development and activity of the opposite side of the body. It would therefore not be irrational to suppose that, by educating the muscles of the left side until they were superior to those of the right, the right brain might then be made the leading side and the recognition of this might possibly give to those of delayed mental development a new centre for the cultivation of the powers of both mind and body.

In maintaining the erect position a large number of muscles of the body are in constant activity. Subjects must sway not only to the heavier side but also to the stronger side. The predominating muscles not only exercise this greater influence of their own, but there is probably added an increment of energy due to automatic tone waves created by the constant strain of other muscles in a state of tension.

This factor, combined with actual excess of tissue, produces in most persons an antero-dextral sway. The sinistral sway is found in a majority of left-handed people. It is found rarely in those who are right-handed.

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[1] Hall and Hartwell, Johns Hopkins Univ., "Mind," No. xxxiii.

[2] Revue de Thérapeutique, Med.-Chir., No. 11.

Twelve individuals, mostly young men in good health, were carefully observed, tracings of the sway being recorded on the drum. There was, with the eyes open, a maximum antero-posterior sway of 1.56 inches and a minimum of 0.32 inch, the average being one inch. Laterally the average was 0.78 inch, the maximum being 1.50 inches, and the minimum 0.24 inch.

With the eyes closed these figures were considerably increased. The averages for forward and back and for lateral sway were increased 80 per cent. and 28 per cent. respectively, making 1.8 inch for antero-posterior, and 1 inch for lateral sway. These figures may be considered normal for young men in health.

Allowing the eyes to wander about the room, though the head be not turned—in other words, the absence of fixation of the eyes, reading aloud, and removal of the shoes and stockings, increase the bodily sway. In one instance the lateral sway of a man was one-fourth of an inch. Removal of the shoes and stockings increased this to 1¾ inches. The antero-posterior sway in the same instance was 1.52 inches, but after removal of shoes 2.88 inches—almost double. Comparisons made with eyes shut, with shoes and without shoes, showed a corresponding increment. In the writer's case this increment was 16 per cent. for antero-posterior and 12 per cent. for lateral sway. In a number of observations the increase of sway varied considerably; no changes were observed excepting that of extent of the oscillation.

Twenty-five girls, between the ages of seven and thirteen, were examined in orphanages. The lateral sway averaged 1.06 inches, the antero-posterior sway 1.08 inches. Shutting the eyes increased this sway about 40 per cent.

Eleven boys yielded slightly greater figures than in the case of girls—an increase of 7 per cent. for lateral sway, and 13 per cent. for antero-posterior sway.

Children sway absolutely more than adults, and there is a greater equality in their cases between the antero-posterior and the lateral sway.

Thirty-nine inmates of the Institution for the Blind were examined, by permission of Dr. Harlan. The average lateral deviation was found to be 1.4 inches; the antero-posterior deviation 1.7 inches. This is about the normal sway of healthy individuals with their eyes shut, and shows that the blind, even after years of experience, are not able to preserve their equilibrium better than the man who is momentarily deprived of eyesight.

Seventeen deaf mutes, between fourteen and twenty-four years of age, were examined at the Institution for the Deaf and Dumb, by permission of Dr. Wharton. The average lateral sway was found to be 0.93 inch, and the average antero-posterior sway 0.85 inch. With the eyes shut the sway increased so that the average for lateral sway became 1.18 inches, an increment of 27 per cent., and the antero-posterior sway 1.31 inches, an increment of 54 per cent. It may be said of these figures that the boys are trained in military practice, and that their shoes are stout and have broad soles. They were all right-handed; they all swayed to the right excepting two, one of whom swayed to the left, the other swayed to both right and left.

Opportunity was taken at this time to test the liability of deaf-mutes to become dizzy. It was discovered by Prof. William James, of Harvard University,[1] that deaf-mutes, in whom the semicircular canals are frequently diseased or destroyed, are not so likely as others to lose their equilibrium or to become dizzy. Three boys were turned rapidly about while standing on their feet; they were then told to walk rapidly down a line on the floor. Although they were turned a dozen or more times, they were all able to walk a straight line without wavering. A fourth confessed he was very dizzy, and diverged widely from the line. The three who were first tested were far better able to keep the line than was the writer.

The influence of ether on station was also observed, with the aid of Dr. W. C. Lott. Tracings from both of us were obtained. We took the ether in the standing position so that the index of the apparatus could write at any desired moment. As the ether was taken the writer seemed to be pivoted as a top when nearly done spinning, and finally it seemed as though the feet were not resting upon any solid foundation. The tracings, apparently, do not show anything more than a great exaggeration of the normal sway.

In several cases of locomotor ataxia the sway with the eyes open was observed to vary from 2.25 inches to 3.75 inches in the antero-posterior line, one from 2.50 inches to 3.25 inches laterally. One of these has been engraved. Six observations with the eyes shut showed a lateral sway of 3 to 6 inches, and antero-posteriorly 3 to 7 inches. An interesting tracing of a case of spastic paralysis showed that the oscillations were almost wholly in the antero-posterior line. Ten tracings from cases of chorea were taken. With the eyes open, the lateral deviation averaged 1.45 inches; the antero-posterior deviation, 2.35 inches. The sway slightly increased when the eyes were shut.

As a result of these observations there arise certain valuable formulæ which point to further physiological research and have direct clinical utility.

They show that the normal man and woman have an average sway of about one inch in the forward and back line, and three-quarters of an inch laterally.

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[1] The Sense of Dizziness in Deaf-Mutes. By Wm. James, M.D. Amer. Journ. Otology, Oct. 1882.

That children sway to a slightly greater extent than adults, and that, both in adults and in children, closing the eyes increases the sway about 50 per cent.

An artificial agent, such as ether, simply exaggerates the normal sway.

That a law of rhythmical motion governs the sway of man. The cause of this is not yet clear.

The methods introduced by Dr. Mitchell for studies of this kind enable clinical inquirers to make accurate statements which may be comparable with the observations of others.

EXCISION OF THE ENTIRE CLAVICLE FOR CENTRAL CARCINOMA.

By John Sloan, M.D.,
OF NEW ALBANY, INDIANA.

James F. M., of Washington Co., Indiana, came to my office November 21, 1885, with his physician, Dr. Maxedon, to consult me in relation to an enlargement of his right clavicle. He was fourteen years old, large and robust. Had had pain in the bone since May; observed an enlargement October 15th, and consulted his physician. It had grown rapidly, extending upward and inward, the greater enlargement about two and a half inches from the sternum. I advised its immediate removal.

He returned November 28th, accompanied by Dr. M. and two other physicians of his town, who, with several others of this city, assisted in the operation. On examining the mobility of the shoulder, before placing him on the table, I fractured the bone, which made the operation more protracted. He took chloroform kindly. An incision was made from the centre of the sternum to a little beyond the acromial extremity of the bone; the parts were dissected from the anterior surface; it was disarticulated from the scapula, a noose of cord placed around it for traction; and it was carefully separated from its connections with probe-pointed scissors and scalpel to the place of fracture. The sternal fragment was seized with forceps, disarticulated from the sternum, and carefully dissected out. Arteries as divided were seized and held by compressors. Capillary hemorrhage was arrested by hot sponges.

The time occupied in the removal was forty-five minutes. Three small tents of twisted marine lint were placed in the wound for drainage, it was closed with wire sutures, dressed with a compress of marine lint and bandage. No vessels required ligation. The drainage tents were removed on the second day; there was moderate suppuration from two places. The sutures were removed on the seventh day; union was complete at the extremities, and a portion of the centre.

On January 13th he returned home, thirty miles, by stage. The wound was healed, except two small points which had scabbed over. Dr. Maxedon remained with and cared for him the first ten days. His highest temperature was 101½°, on the second day; afterward normal. Morphine was given for a few nights to procure sleep, and an occasional laxative.

The circumference of the bone, three inches from the sternal articulation, was five and a half inches. On section it presented a thin shell of bone exteriorly with calcareous infiltration throughout the interior; I dissolved the bony and calcareous material in dilute hydrochloric acid, made some sections, stained them in picro-carmine, and mounted them in glycerine. They showed a dense stroma of connective tissue, with some spindle cells, and large nests of cancer cells. He visited me about the 5th of April; there was evidence of the return of the cancer in the line of the cicatrix, and in the glands of the neck.

REVIEWS.

RECENT WORKS ON OPHTHALMOLOGY.

THE REFRACTION AND ACCOMMODATION OF THE EYE, AND THEIR ANOMALIES. By E. LANDOLT, M.D. Translated by C. M. CULVER, M.D. Edinburgh: Young J. Pentland, 1886.

THE HYGIENE OF THE EYE IN SCHOOLS. By HERMAN COHN, M.D. Translated by W. P. TURNBULL. London: Simpkin, Marshall & Co., 1886.

THE DIRECTION OF THE LYMPH-STREAMS IN THE EYE. By H. GIFFORD, M.D. *Archives of Ophthalmology,* June, 1886. New York: Putnam & Sons.

A CONTRIBUTION TO THE STUDY OF SYMPATHETIC OPHTHALMITIS. *Archives of Ophthalmology,* Sept. 1886.

REPORT OF THE COMMITTEE ON SYMPATHETIC OPHTHALMITIS. *Transactions of the Ophthalmological Society of the United Kingdom,* vol. vi. 1886. London: J. & A. Churchill.

ON A CASE OF MENINGITIS FOLLOWING EXCISION OF THE EYEBALL. By E. NETTLESHIP. *Archives of Ophthalmology,* September, 1886.

EITRIGE MENINGITIS NACH ENUCLEATION. By R. DEUTSCHMANN. *Archiv für Ophthalmologie,* xxxi. iv. p. 251.

L'ANTISEPSIE COMME MOYEN PRÉVENTIF DES DANGERS DE MORT APRÈS LES OPERATIONS ORBITAIRES. By L. DE WECKER. *Annal. d'Oculist.,* Jan., Feb., 1886.

TRAITÉ COMPLET D'OPHTHALMOLOGIE. Par L. DE WECKER and E. LANDOLT. Tome III. fasc. 3e. Paris: 1887.

SUBJECTIVE SYMPTOMS IN EYE DISEASES. By G. BERRY, M.D. Edinburgh: Oliver & Boyd, 1886.

THE CAUSES AND PREVENTION OF BLINDNESS. By DR. ERNEST FUCHS. Translated by DR. R. E. DUDGEON. London: Ballière, Tyndall & Cox, 1885.

DISEASES OF THE EYE. By DR. FERDINAND VON ARLT. Translated by S. WARE, M.D. Edinburgh: Young J. Pentland, 1886.

OUR object in the following pages is not so much critically to review the works enumerated above as to consider in what direction the science and practice of ophthalmology are likely to be affected by them; we shall therefore have little to say concerning their defects and omissions, but shall deal almost entirely with their positive aspect.

The estimation of correction of errors of refraction forms so large a portion of ophthalmic practice that no apology is needed for dealing first with works on this and allied subjects.

There can be no question that Dr. Landolt's work will, for many years, be the standard authority on refraction. The scientific study of this branch of ophthalmology may be said to date from the publication of Donders's *Anomalies of Refraction and Accommodation*, and Helmholtz's *Physiologische Optik*. Since then, no original work of importance has appeared, and although many minor treatises have been written, these have dealt almost exclusively with the means of diagnosticating the more common abnormalities, and have made no attempt to treat the subject exhaustively. Since 1860, however (the date at which Donders's book appeared), very great changes have been introduced. The use of the ophthalmoscope has become more general, and its construction immensely improved, the refraction instruments which a few years ago were expensive instruments, only possessed by a few, are now the rule, and, as a consequence, great importance is attached to all objective tests. The introduction of the metrical system and its adaptation to the measurement of convergence have much simplified calculations. At the same time an enormous amount of information, statistical and otherwise, has been collected on the subject of myopia and the causes of its increase. All these facts point to the want of a standard work which shall serve as a fresh starting-point. This is to a great extent supplied by the book before us.

Of the physical portion there is not much to be said, since most of the facts are now common property. The mathematical elements are less prominent than in Donders, while an abundance of excellent illustrations saves much verbal explanation. The optical constants adopted are those of Helmholtz, and this portion of the book will be extremely useful for reference.

Our chief interest here, however, is with the clinical portion. The author's optical treatment of ametropia differs considerably from that adopted generally. In hypermetropia he makes no attempt to correct the whole or even nearly the whole of the defect, but encourages the patient, even in distant vision, to use two-thirds of his total accommodation. For instance, a patient with hypermetropia of 5 D., whose amplitude of accommodation was 3 D., would still be permitted to use two dioptres of an accommodation, and would therefore be ordered + 3 D. The correction for near vision is calculated in the same way. It appears to us that the plan ordinarily adopted of correcting the whole of the manifest hypermetropia and a constant fraction of the latent, is more sound theoretically, and practically as satisfactory. Dr. Landolt's plan, indeed, appears to aim at correcting as little of the hypermetropia as may be, while the aim of the other is to correct the defect as nearly as possible, and thus coax the patient to relax his accommodation.

The optical treatment of myopia has always been a matter on which there was some diversity of practice. On this subject Dr. Landolt has no hesitation, but emphasizes the following rule by printing it in small capitals, "A myope must be prohibited from wearing concave glasses for any distance at which he can see without accommodating." In other words, a myope of 3 D. must be forbidden to wear his correcting glass when looking at objects at 33 cm. (13 inches) or nearer. This would, we believe, entail considerable inconvenience upon many patients without any corresponding advantage. For years past it has been the practice in England to allow myopes of moderate degree to wear their full correction for all purposes, except when the disease is progressing, and no harm has been found to result.

The author's well-known interest in all that relates to the ocular muscles gives to his remarks on this subject an authoritative character. This part should be read in connection with the chapter on the same subject in the *Traité complet.* We are at present probably only on the threshhold of this subject, and much remains to be done. This portion of the book, however, forms an able *résumé* of our present knowledge, for much of which we are indebted to Prof. Landolt himself.

Donders's statements as to the relations which exist between convergence and accommodation still hold good, and the adaptation of the metrical system has rendered it more easy of demonstration. Nearly all the facts, however, as to the relative amount of convergence and divergence possible to different individuals are more modern. The rules for guidance in the adoption of operative or other treatment are laid down upon a logical basis. The position of parallelism of the visual axes is denoted by zero, and divergence and convergence are expressed in metrical angles with the sign — or + prefixed. The normal standard taken is an amplitude of convergence of ten metrical angles (m. a.), of which one is negative and nine positive. This may be departed from in many ways. The range of convergence may be normal, but the whole may be carried too far to the negative or positive side, or the amplitude may be curtailed at either or both extremities. Whenever the positive convergence fails there is asthenopia in near vision. Convergence is measured by means of Landolt's ophthalmo-dynamometer and divergence by prisms. Tenotomy of the abductors diminishes the negative portion of the range, and increases the positive at least to the same extent, and usually, if the adductors are sound, to a greater extent. It is, of course, only available when part of the range is negative, or actual convergence would be produced. When the internal recti are weak, as shown by shortening of the positive range, it does little good and one or both internal recti must be advanced. If the external recti are weak tenotomy of the internal may be performed also. When the amplitude of accommodation is much below normal the case is not well adapted for operative interference.

A work of a totally different character, yet dealing with very kindred subjects, is Cohn's *Hygiene of the Eye in Schools.* It is not, indeed, a new work, but until the appearance of this translation it was not very familiar to English readers. If some such book were used as a textbook for all engaged in teaching we should see less of the evil effects produced during school-life from ignorance of the capabilities of the growing eye. Its appearance is especially opportune just now, when there has been a tendency shown to minimize the evils of myopia, and to regard it in some quarters simply as a physiological adaptation of the eye to the requirements of civilized life. After an introductory portion adapted for the laity, we come to the real pith of the book—a description of the faulty positions assumed by school-children, and the defects of school desks, bad illumination, and faulty type, which necessitate or facilitate such positions.

The main interest of the book from a medical point of view, however, centres round the oft-quoted statistics. These should be read in conjunction with Dr. Randall's comprehensive paper "Refraction Statistics," *American Journal of the Medical Sciences*, 1885. These prove conclusively that the number of cases of myopia and its degree progressively increase from the lower to the higher classes of schools, and are greater in the higher than in the more elementary schools, in which the average age of the scholars is the same.

Of late years the views prevalent regarding refraction have been greatly modified. It may now be considered established that hypermetropia is the normal condition at birth, and that emmetropia is seldom reached till the age of six or eight, that after this age a considerable proportion of children become myopic.

Much more valuable, in our opinion, than these colossal statistics are those, more limited in number, which show the changes undergone by individual eyes in a certain number of years.

It was long believed that hypermetropia was a stationary condition, and that the cases of myopia were derived from eyes which were originally emmetropic. No less an authority than Donders has expressed the opinion that hypermetropic eyes did not become myopic. If, however, all eyes are originally hypermetropic it is evident that this view must be abandoned; indeed, the statistics just referred to seem to show that a very considerable number of children who are still hypermetropic at the commencement of school-life eventually become myopic. Nor is it possible any longer to maintain that sharp distinction between progressive and stationary myopia which has, until lately, been customary, for there are numerous statistics which show that myopia nearly always continues to increase to some extent during the whole of school-life. Of course, there is marked and most important difference between a myopia which ceases to increase at puberty, or thereabouts, and is unaccompanied by atrophic changes in the choroid, and that form of it which continues to increase throughout life, and is accompanied by atrophic changes in the region of the posterior pole. Landolt and others name the first typical myopia, and the second atypic or malignant.

Of the statistics showing changes taking place in the same individuals we quote those of Erisman and Reich,[1] as in each the interval was as long as six years (the latter are not given by Cohn). Erisman found 23 per cent. and Reich 25 per cent. only whose refraction had not increased. Of cases of hypermetropia which had passed into myopia Erisman found 13 per cent., while the proportion of emmetropes who had become myopic was only slightly greater, namely 16 per cent. Reich's figures are much higher, but the relative proportion is nearly the same. Now when it is considered that the slightest increase in the refraction of an emmetropic eye renders it myopic, while the hypermetropic has first to become emmetropic, it is apparent that the eye which remains hypermetropic beyond the normal period, is one which, under the influence of school-life, is very liable to become myopic. There are statistics to determine whether myopia thus produced is of a rapidly progressive character.

The last volume of the *Transactions of the Ophthalmological Society*, though containing much that is of interest, will contribute most to the permanent advance of ophthalmology through the comprehensive report of the Committee on Sympathetic Ophthalmitis, and Mr. Nettleship's paper on "Meningitis following Enucleation."

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[1] Arch. für Ophthal., xxxi.

In connection with the former we take Gifford's important papers, which have certainly thrown new light upon the pathology of sympathetic inflammation. The author states that his experiments were originally undertaken with the intention, and in the expectation, of confirming Deutschmann's results. To make the significance of Gifford's results apparent it will be necessary briefly to glance at the position to which Deutschmann's[1] experiments had brought our knowledge of the pathology of this affection. Injecting pyogenic micrococci into the vitreous of one eye in rabbits, he had almost always succeeded in producing papillitis in the other, which persisted till the death of the animal, which always occurred within a few weeks. On examining the parts, the microörganisms were found in abundance in the intersheath spaces of both optic nerves, in greater quantity as the globes were approached, and around the chiasma. When the infecting material was introduced into the optic nerve which had been ligatured on the proximal side, inflammation of the uveal tract was set up, from which it was concluded that the immunity enjoyed by this in the other experiments was due to the early death of the animal. In order to test the applicability of these experiments to sympathetic ophthalmitis as it occurs in man, culture experiments were made with aqueous, and portions of iris removed during life from the sympathizing eye. The microörganisms thus reared appeared to possess all the properties of those inoculated in the original experiments, and they produced the same effect when injected into the rabbit's eye. The existence of microphytes in the exciting eye having been previously proved, the chain of evidence as to these being the cause of the inflammation of the second eye seemed fairly complete, and it was not unnaturally concluded that the microphytes had travelled from the first eye to the second along the optic nerve sheaths and chiasma. Their passage might indeed be considered proved, but as regards their mode of transit there were at least two weak points in the evidence. In the first place, it is necessary to assume that in one nerve they travelled against the lymph stream. Secondly, why should they be more redundant near the globes? An obstruction at the papilla of the second eye would explain their accumulation behind it, but why should there be a similar condition in the nerve of the first eye? Gifford's experiments throw light upon both these points. In his first paper he cleared the ground by showing the direction of the normal lymph currents between the eyes and the brain. In numerous experiments injections of colored substances were made into the vitreous with the following results:

> "When a small drop of sterilized water, containing Indian ink or cinnabar in suspension, is introduced there is generally little or no reaction. The next day, or later, if the injection is made far forward, one sees with the ophthalmoscope the particles collecting in the optic excavation; if the animal be killed a day or two later, the central canal is marked by a black or red line which leaves the nerve with the vessels, and can be traced a short distance toward the apex of the orbit. Microscopically one sees that the granules are contained in the perivascular lymph spaces. They can also be traced along the small vessels given off to the papilla, nerve, and choroid. None were found in the intervaginal or dural sheath. . . . Anthrax bacilli followed the same course, but did not enter the finest canals. As they multiply where-

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[1] Archiv für Ophthalmologie, xxx. iii.; xxvii. ii.; xxix. iv. etc.

ever they are carried, they are found in considerable number in the orbit, and if the animal lives long enough, in the cranial cavity."

These experiments clearly demonstrate the existence of a lymph current from the vitreous to the brain along the bloodvessels.

Gifford then repeated Quincke's[1] experiments of injecting cinnabar into the cerebral subdural space after trephining, and found that it travelled down the intervaginal space of each optic nerve, being more abundant near the globes. The fact that the suprachoroid can be readily injected from the intervaginal space perhaps answers one obvious objection to the bacterial theory of sympathetic inflammation—namely, that the chief stress of the affection is not upon the optic papilla and retina, but upon the uveal tract.

Gifford's second paper has a more immediate bearing upon pathology. His experiments with the same microörganisms as were used by Deutschmann led to very different results; the animals did not die, there was no permanent effect produced on the other eye, and, although there was inflammatory exudation into the sheaths of the nerve for some distance behind the eye, in no instance did the micrococci themselves extend beyond the lamina cribrosa.

We do not propose to discuss the several explanations which might be given of these experiments, giving different results to those of Deutschmann, but pass to Gifford's experiments with the anthrax bacillus. One difficulty with this bacillus is, that if the subconjunctival tissue is inoculated the animal dies. It was exceedingly difficult to prevent this, hence the negative result as regards affection of the second eye of the majority of the experiments. The three cases, however, in which this was affected are extremely instructive. In each the bacilli could be traced along the vessels to the apex of the orbit; they were present in the cranium around the chiasma; they were to be traced *down* the intervaginal space of each nerve, increasing in quantity near the eyes.

It is manifest that these experiments are too few to establish any theory upon. Still, taken in conjunction with those bearing on the course of the lymph-currents, they are significant. While strengthening the theory that migration of microörganisms is the exciting cause of sympathetic ophthalmitis, they render it extremely doubtful whether the optic nerves can be considered as the direct channel of communication. If the mode of infection suggested by these experiments should be confirmed by others. several difficulties, which have hitherto stood in the way of accepting the bacterial theory, will be removed, and if there is really this double road by which the bacilli can travel, it is not at all impossible that a relapse of inflammation in a sympathizing eye may react upon the exciting eye, a possibility in favor of which there is some clinical evidence.

The report of the Committee of the Ophthalmological Society on "Sympathetic Ophthalmitis" is of a different nature from the papers just quoted, the evidence being entirely clinical. The report is based upon 200 cases collected from various sources. Of these, fifty ended in complete recovery, and a very considerable number had useful vision. Obviously, however, this does not give the real percentage of recoveries, as there would be a much greater tendency to publish the successful cases. The same difficulty, though to a less extent, arises in estimating the effect of various modes of treatment. The Committee have rightly been chary of drawing conclusions, and have merely arranged the facts bearing on the different points. Some conclusions do seem, however, fairly deducible. We should say that Mauthner's view that enucleation of the exciting eye aggravates a mild attack of sympathetic inflammation, if not disproved, is, at any rate, rendered extremely improbable.

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[1] Reichert's and Du Bois Reymond's Archives, 1872.

One of the points on which the Committee endeavored to collect evidence was as to the possibility of sympathetic ophthalmitis occurring without a perforating lesion of the exciting eye. Considering the very wide field over which the evidence was sought, it is impossible to avoid the conclusion that had this been possible unequivocal examples would have been found. Of course, it is necessary to exclude at the outset all cases in which the first eye suffered from spontaneous irido-cyclitis from a constituted cause, for in such it is impossible to exclude the action of the same cause upon the second eye. The only cases admissible would be those of injuries without perforation, or of affections which are dissimilar to sympathetic iritis (for a constitutional cause would not produce different symptoms in the two eyes). Since, however, spontaneous uveitis may occur in the second eye, it is evident that cases must be accepted with great doubt in which the affections of this eye did not appear until long after the usual interval which separates the affection of the two eyes in true sympathetic ophthalmitis. Now of the eight cases which have been selected as the only ones approximately fulfilling the conditions, in two there was an interval of sixteen and twenty years respectively, while in the remainder the evidence of no perforation having occurred was far from being conclusive. Genuine cases, had they occurred, would certainly have been published and the absence of such is strong evidence of their non-existence. It is evident that this strengthens the view of the septic nature of sympathetic inflammation.

The series of cases in which the symptoms did not appear in the second eye until after removal of the injured eye is of great interest. The general mildness of these cases seems clearly to point to enucleation being likely to influence the course of sympathetic inflammation favorably. There are numerous other points on which the evidence is very suggestive, but for these we must refer to the report itself.

That meningitis which is generally fatal occasionally results from enucleation has long been known. The cases, however, that had occurred were scattered throughout medical literature, and it was difficult to estimate the frequency of the complication or to arrive at definite conclusions as to its pathology. In the papers of Nettleship, Deutschmann, and de Wecker attempt has been made to collect all the published cases, and although these probably represent but a proportion of those that have actually occurred, much can be learnt from their comparison. Perhaps a better idea of the percentage of the enucleations that are followed by meningitis can be formed by taking the percentage of individual operators. Thus de Wecker and Alfred Gräfe, *Exenteration ver Enucleation Bulbi*, 1884, give an almost identical percentage—namely, 0.3 per cent.

Deutschmann's paper gives an account of twenty-six cases, de Wecker of one that is not included in this, Nettleship gives one of his own, and six others not previously published. We have thus a total of thirty-four cases; it would be well, however, to exclude one of Deutschmann's in which the operation was complicated by the removal of a malignant tumor from the orbit, and one of MacHardy's, in Mr. Nettleship's paper, in which the eye was not enucleated, but torn out by the patient himself.

De Wecker's case is not free from doubt, since there is no record of the temperature, and the patient died at home. No post-mortem examination was made.

Several important questions arise in connection with these cases. In the first place, the uniformity of the interval that separates the operation and the commencement of the symptoms leaves no doubt that the meningitis was really caused by the operation. Thus, in twenty cases in which the interval is given, it was twenty-four hours or less in eleven, between twenty-four and forty-eight in five, and over forty-eight in only four (Nettleship). Whether the condition of the enucleated eye has any share in causing the meningitis is a question that has been much discussed, but which cannot at present be determined. The condition is mentioned in twenty-seven instances, in fourteen of these suppurative panophthalmitis was or had been present. Long ago von Gräfe laid down the dictum that an eye should not be excised when in a state of active suppuration, and, as there are no data to show to what extent this rule has been followed, it is impossible to say what value can be attached to the above figures. It is curious that of the five cases which recovered after developing symptoms of meningitis, four were cases in which there had been no suppuration.

In all the cases except four there had been a perforating lesion of the enucleated eye, and, therefore, the possibility of septic inflammation. De Wecker attributes considerable importance to inoculation of the orbital tissues with the contents of the globe at the time of the operation. As a matter of fact, rupture of the globe did occur in a considerable proportion of the cases, and inoculation could easily occur in those in which the wound was recent or unhealed.

The post-mortem appearances were extremely variable, the meningitis was of a purulent character in nearly all, generally affecting the convexity of the brain as well as the base, and in some instances being even more marked in the former situation. Although the sheaths of the optic nerve offer the most obvious channels for the transmission of the inflammation, changes were found in only three instances, while in six others the most minute microscopical examination failed to discover any abnormal condition in the nerve sheaths. The cellular tissue of the orbit appeared to be normal in nearly all the cases. The implication of the convexity leads Nettleship to think that the veins form the channel of communication, which might be the case without there being obvious changes in them. In view of Gifford's investigations as to the course of the lymph stream from the eye to the brain, infection travelling along the central vessels of the optic nerve is by no means impossible. There are, probably, however, several channels by which the inflammation may travel, and it is possible that the same are not always implicated.

This subject, of meningitis following enucleation, has an especial importance at the present time because attempts have recently been made to introduce substitutes for the operation. Both in Deutschmann's and de Wecker's papers it is contended that exenteration is safer in this particular respect. We do not propose to enter here on a discussion of the relative advantages and disadvantages of these two operations. It is obvious that their relative safety in regard to a complication which occurs only three times in a thousand operations can at present only be discussed on theoretical grounds. If the meningitis is in any way dependent upon inoculation with the contents of the eye, then it surely must be safer to remove these enclosed in a dense covering of normal tissue, as is done in enucleation, than to make an incision into the inflamed cavity and remove piecemeal as much of the contents as possible as is done in exenteration. In this latter proceeding inoculation of the conjunctival wound cannot be avoided, and it is impossible to follow microörganisms into crevices formed by irregularity of tissues, or the orifices of vessels. If, on the other hand, it is assumed that the meningitis results from infection of the wound at some period subsequent to the operation, this ought to be obviated by using strict antiseptic precautions. Practically the choice between exenteration and enucleation will be decided on totally different grounds.

If we were asked in what respect ophthalmology has recently contributed most to the advancement of medical science, we should point to the aid that it has afforded to the localization of cerebral affections. The present position of science in relation to this important subject is well delineated in a most able and exhaustive article by J. P. Nuel in the last volume of the *Traité Complet.* In conjunction with this might be read Dr. Berry's little book, which, although in many instances merely touching the surface of the subjects treated of, yet forms a valuable contribution to the medical aspect of ophthalmology.

As showing how recent has been the advance of our knowledge in this respect we may remind the reader that it is only quite in recent years that the question of partial or total decussation of the optic nerve was keenly discussed, whereas now, not only is it universally admitted that the fibres of the right halves of the two retinæ go to the right optic tract, and *vice versa,* but much progress has been made in tracing them to their ultimate destination.

In regard to the latter there is, however, still considerable difference of opinion. According to Charcot, all the fibres which do not decussate at the chiasma do so a little behind the corpora geniculata. According to this view, lesion of one hemisphere behind this point would produce total blindness of the opposite eye. This scheme has, however, not been generally adopted, and the clinical evidence appears to be against it. Nuel seems to ignore Charcot's theory, does not discuss the probability of there being any decussation behind the chiasma, and considers the whole matter settled by the following rather bold assertion, "numerous examples of homonymous hemianopia (*i. e.,* loss of the right or left halves of both visual fields) from lesion of the opposite hemisphere, especially of the cortex of the occipital lobe, prove that all the fibres of one optic tract go to the hemisphere of the same side." It is evident, however, that this assertion is too sweeping, since Ferrier (*The Functions of the Brain,* 1886) gives sufficient experimental and pathological evidence to show that sometimes the blindness thus produced is only temporary, and that in several experiments the lesion of the whole of one occipital lobe, and even of both, has not been followed by any impairment of vision. On the other hand, destruction of one angular gyrus produces total blindness of the opposite eye and not hemianopia. The only scheme which at present appears consistent with all the facts is that proposed by Ferrier, namely, that each occipital lobe, in virtue of the semidecussation at the chiasma, is in relation with the corresponding half of each retina, but that each angular gyrus is in relation with the fovea centralis of the opposite eye only, some of the fibres decussating near the corpora geniculata, and others at the chiasma.

Nuel lays down very clearly the character of hemianopia from cerebral lesions, the sharp limitation and symmetry of the scotomata being important features. The loss of activity by the pupil, when the lesion implicates the optic tract, and its retention when it is in the occipital lobe, are also pointed out.

Both this author and Berry mention the fact that in hemianopia from lesions of the tract, the optic disk of the eye of the side opposite to the lesions shows signs of atrophy before the other; this is explained by the fact that the direct fibres are covered by the crossed ones.

In Dr. Berry's book are some valuable hints as to the significance of the impairment of the light-sense; this is a subject which has been allowed to fall very much into oblivion; yet it may sometimes afford valuable indications—for instance, when there is considerable opacity of the vitreous, the fact that the light-sense was not much impaired would, it is said, exclude the existence of the detachment of the retina. In glaucoma simplex there is great diminution of vision with feeble illumination, and but little difficulty in distinguishing between different degrees of intensity in the light, whereas in optic atrophy these conditions are reversed. There is, however, much practical difficulty in applying subjective tests of this nature to patients of only average intelligence.

Dr. Berry discusses the somewhat difficult subject of the vision of those who are color-blind very clearly, and ably supports Hering's theory that color vision depends upon the existence in the retina of three substances, each of which is acted upon in two ways by opposed (or complementary) colors, and that defects in color-vision depend upon the absence of inertness of one of these. This theory necessitates the view that color blindness cannot exist for one color, but must concern a pair of complementary colors. Perhaps the best proof that this is really the case is furnished by Masson's disk; the colors are so arranged that the sensation of gray is produced in the normal eye when the disk is rotated; amongst the colors are placed two which are complementary. If both these are removed, the effect of gray is preserved, while if only one is removed a sensation of color is produced. Now to the color-blind also the first mixture appears gray; if, however, only one color in it failed to affect the sensorium, the remainder should give rise to a color impression. If, however, we admit that defect for one color necessitates also a defect for its complement, that does not altogether disprove the Young-Helmholtz theory, though it certainly weakens it.

Professor Fuchs's essay on the "Causes and Prevention of Blindness" is a valuable contribution to ophthalmic literature, since it brings to a focus our scattered knowledge upon a variety of subjects, and presents it as a vivid picture. It touches on many points which are of importance to several sections of the community. The chapter devoted to the effect of school-life upon the eyes well deserves the serious attention of all who have to do with school construction or management. The ground is much the same as that covered by Cohn's *Hygiene* already referred to, but the enormous difference in the demands made upon the school children of Germany and England is well brought out, a difference which has its fruit in the great prevalence of myopia in the former. The plan of lighting by the electric light that is recommended, is to have a very bright light hung from the centre of the room, beneath this a concave mirror which conceals it from view, and throws the light on to the white ceiling from which it is reflected to all parts of the room. Probably this, when the conditions are properly observed, would give the nearest approach to diffuse daylight that could be obtained.

We propose, however, to confine our attention to the medical points of interest. In the chapter on congenital and hereditary affections, the question of the influence of consanguinity of the parents on the occurrence of retinitis pigmentosa in the offspring is discussed with more impartiality than has previously been the case. Many previous statistics have been vitiated by the circumstance that they have been compiled from exceptional sources—for instance, the inmates of asylums for deaf-mutes; but a large proportion of these are known to be the offspring of consanguineous marriages. Taking 147 cases of retinitis pigmentosa collected from various ophthalmic clinics, 34 per cent. were found to be the offspring of consanguineous marriages. Now the proportion of these marriages (in France) to all marriages is only about 1 per cent. There is, of course, the obvious objection that the cases of retinitis were collected from several countries, and the statistics of marriages from France, but the disproportion is too great to be explained thus.

In dealing with contagious affections of the conjunctiva, Fuchs adopts the classification of Arlt, which has not generally been followed, though there is much to be said in its favor. Blennorrhœa is divided into acute and chronic, the former including all forms of purulent ophthalmia, and the latter muco-purulent and granular ophthalmia, the papillary and follicular granulations being considered as different manifestations of an identical disease. The main argument in favor of this is that in an epidemic of ophthalmia all these affections are met, and that a considerable number of instances have been observed in which different affections have followed infection from the same source. Sattler appears, however, to have been mistaken in considering the micrococcus found by him in trachoma as identical with the gonococcus. According to Zehender (Bowman, lecture, *Lancet*, Nov. 27), the trachoma microzoon "is a diplococcus very like the gonococcus, but smaller, and cleft by a tiny line. It can be cultivated in various media, whereas the gonococcus will only propagate in blood serum."

Arlt's book is of interest as embodying the views of one who has probably had a very much larger experience than any living ophthalmologist. It is, however, only the first part of a projected work, and the subjects with which it deals—affections of the conjunctiva, iris, and cornea—are not those which give much scope for originality. Unfortunately, the manuscript appears to have been completed before cocaine came into use; and, although the translator has endeavored to supply the defect by numerous interpolations, the success is naturally but indifferent.

The classification of the different forms of conjunctivitis has been already referred to. The evidence in favor of infection through the medium of the air is fully discussed, a possibility which is consistent both with clinical facts and with what we know of other infecting material. It has, however, been denied by Stellwag von Carion and other authorities. The section devoted to sympathetic inflammation is meagre, and not up to date. No well-marked distinction is made between sympathetic neurosis and ophthalmitis. The theory of excitation through the medium of the ciliary nerves is adopted; but the arguments that have been adduced against it are not mentioned, neither are Deutschmann's experiments. Indeed, the whole section reads as if it had been written ten years ago. There is an interesting section devoted to the cysts of the iris that occasionally follow a perforating wound, but Hulke's well-known paper on the subject is not referred to. W. A. F.

RECENT WORKS UPON OPERATIVE SURGERY AND SURGICAL TECHNIQUE.

1. THE PRINCIPLES AND PRACTICE OF OPERATIVE SURGERY. By STEPHEN SMITH, A.M., M.D., Professor of Clinical Surgery in the University of the City of New York. A new and thoroughly revised edition. 8vo. pp. 877. Philadelphia: Lea Brothers & Co., 1887.
2. MANUAL OF OPERATIVE SURGERY. By JOSEPH D. BRYANT, M.D., Professor of Anatomy and Clinical Surgery in Bellevue Hospital Medical College, New York, etc. 8vo. pp. xxvi.–530. New York: D. Appleton & Co., 1887.
3. MANUAL OF OPERATIVE SURGERY. By W. ARBUTHNOT LANE, M.B.M.S., F.R.C.S. 12mo. pp. 276. London: George Bell & Sons, 1886.
4. HOW WE TREAT WOUNDS TO-DAY. By ROBERT T. MORRIS, M.D., late House Surgeon to Bellevue Hospital. 16mo. pp. 162. New York: G. P. Putnam's Sons, 1886.

1. THE first edition of Dr. Stephen Smith's magnificent work was issued in 1879, and it has since gone through eight large issues, but without any alteration of the text. The present edition is, therefore, called the "second" by the author, but we think he does himself injustice in so doing. If we understand the matter correctly, this is the tenth edition, and we bear witness that it is "thoroughly revised." This work is too well and too favorably known to require any words of commendation, and its merits effectually protect it from adverse criticism. It is not a manual of operative surgery, but a treatise upon the principles as well as the practice of mechanical surgery, requiring for its elaboration 877 large octavo pages. The subject-matter is brought down to the very latest period, hence we shall find the work to be a faithful exponent of the art of surgery as it is practised now.

So comprehensive is the scope of the work that it might almost be considered a treatise upon the whole science and art of surgery. The opening pages call attention to the "civil obligations of the surgeon," in which it is stated that "whoever undertakes to practise any art or profession assumes an obligation, both civil and professional, which, though implied, has all the force and validity of a formal contract." This obligation requires that he shall possess: 1st, reasonable skill, knowledge, and experience; 2d, that he shall use ordinary care in the exercise of his skill; and, 3d, that he shall use his best judgment. As the science of surgery is a progressive one, those who practise the art must assume new obligations as advances are made, hence it is held by the author, and we heartily agree with him, that "antisepsis implies new obligations" upon the practitioner, and "if, through ignorance or negligence, he fail, in any given case, to apply these principles with reasonable care and diligence, he would be justly held responsible for any unfavorable results due to conditions which antiseptic treatment would have prevented."

Following such a statement as we have just quoted, it is but to be expected that there shall be a thorough discussion of the principles and practice of antiseptic surgery, and this is done in a simple manner which can be readily understood by any one. Whilst the author is earnest in his advocacy of the antiseptic method, it is with the great principles of surgical cleanliness that he concerns himself, rather than with any special line of antiseptic practice. Surgeons are pretty well agreed at this time upon the best methods of antisepsis, and but few confine themselves to the original Listerism, or to any other rigid and unalterable system. Soap and water for cleansing purposes, irrigation of the wound and the part to be operated on with solutions of bichloride of mercury, carbolic acid solutions for disinfection of instruments, and a combined iodoform and sublimate dressing for the wound, with certain modifications here and there, form the method most in vogue at this time, and the various details of the application of these agents are fully discussed in the text. In view of the splendid achievements of modern surgery we feel tempted to exclaim, "bold is he and with triple brass around his chest who commits his fragile (surgical) bark to the cruel waves" of chance, without first invoking the protection of antisepsis.

A short section is devoted to the consideration of wound fevers, and it does not seem to us that justice is done to these important complications, as but three and three-quarter pages are devoted to them. It also seems to us that the pathology of these affections is more settled than would be expected from a perusal of the context. Many subjects are carefully considered which are usually omitted in works on operative surgery, amongst these are fractures and dislocations. These very important and practical topics are rather briefly, but succinctly, treated.

We are glad to note the judicious conservatism of the author in regard to new and unsettled procedures; thus, in speaking of fractures of the patella his views are eminently wise and conservative. He presents a tabular statement of the results of wiring the patella, as follows: total cases, 182; recent, 81; old, 53; results good, 75; fair, 35; poor, 24; suppuration, 34; amputation, 4; deaths, 11; total ankylosis, 14; not known, 31; under treatment, 9. "In simple fracture without complication, wiring the fragments gives no better results, as far as relates to the usefulness of the limb, than the judicious employment of apparatus," an opinion which tallies exactly with our own. We have never been able to see how it could be justifiable to cause the death of four or five persons in every hundred in order to obtain a slightly better functional result. We are surprised that no mention is made of Kocher's method of reducing dislocations of the shoulder, which is, we believe, a very great oversight, as it is certainly one of the easiest, safest, and most successful of all the many procedures which may be used for effecting reduction of this dislocation.

The section devoted to the osseous system includes fractures, dislocations, diseases of the bones, and joint-diseases; and whilst it is impossible to treat exhaustively of so many subjects in 117 pages, the descriptions of the diseased conditions, and especially the mechanical and operative procedures necessary to remedy them, are clear and practical. The subject of operations upon bone, resections, excisions, osteotomy, etc., is particularly well handled; not only are the usual typical operations described, but the various osteoplastic methods which have come into use during the past few years.

The fourth section is devoted to diseases and injuries of the circulatory system, including ligation of the arteries. The next section is devoted to the diseases of the nervous system, and, as is to be expected, considerable space is taken up with cerebral localization. The remarkable operation of R. J. Godlee is mentioned, but the brilliant work of Victor Horsley is probably of too recent a date to have secured mention in this book. Fluhrer's remarkable case of removal of a bullet from the brain, by trephining upon the opposite side of the head from that at which the missile entered, receives merited mention. Nerve suture and nerve stretching receive brief notice, scarcely as much as their importance demands.

Passing over the chapters devoted to affections of the tegumentary system, the lips, tongue, pharynx, and œsophagus, all of which receive adequate treatment, we pause to seek the opinion of the author in regard to the new operations upon the stomach. He seems to hold a somewhat neutral position in regard to the justifiability of gastro-enterostomy, digital divulsion of the pylorus, and pylorectomy, and prefers to await further developments in regard to them, but says all surgeons should be familiar with the details of these operations. In regard to penetrating wounds of the abdomen, and especially those inflicted by firearms, Dr. Smith says:

> "The experience of the past has been that shot injuries of the small intestine are always fatal if treated upon conservative principles, but the experience of the present is that some patients may be saved by exploring the abdominal cavity, cleansing it of all effused matters, and closing the wounds of the viscera."

He, therefore, adopts Senn's dictum that the surgeon who allows a patient to die from a penetrating abdominal wound without, at least, proposing laparotomy "has failed to discharge the duties imposed by modern surgery." Whilst we believe these views to be true in the main, we think they are a little too sweeping. We do not think there is any doubt that recoveries took place after gunshot wounds of the small intestine during the late war, but they were very few in number. Dr. E. G. Waters, of Maryland, reports in the *Medical and Surgical History of the War of the Rebellion*, a case of gunshot injury of the abdomen in which he, at least, considered the small bowel to have been wounded; the patient recovered and was alive and in good health at a recent date.

The consensus of professional opinion at this time is decidedly in favor of laparotomy in these abdominal injuries, and we think justly so, but the question is far from settled. Should laparotomy be performed in every case of penetrating wound? What cases may be left to nature? What are the comparative results of expectant, and of operative treatment, etc.? are questions which further observation will determine, but which will require a great war or series of conflicts for their solution.

The treatment of intussusception is summarized: First, quiet spasm by giving opium or belladonna; second, attempt reduction by forcibly, but gently kneading the bowels, changing the position from time to time. If these measures do not succeed, not more than two days should be allowed to elapse before proceeding to laparotomy. The author's position in regard to laparotomy for intestinal obstruction in general, is that which is held by most surgeons at this time: try medical means, opium, enemata, posture, etc., and if they do not succeed perform abdominal section after the lapse of three or four days.

The length which this review has already reached admonishes us that we must omit any special notice of operations upon the liver, spleen, pancreas, and kidneys, as well as of the radical cure of hernia, all of which will be found carefully considered. The author does not apparently approve of attempting the radical cure of hernia at the time of operation for strangulation, at least there does not seem to be any mention of it. Extirpation of the larynx is recommended in cases of malignant disease within that organ, but the results are not held to be encouraging.

This work will be found to represent the prevailing surgical opinions very faithfully, not only in regard to the recognized operations, but to those which are struggling for recognition as well. We must, however, pass over many subjects of marked interest, and pause at the chapter devoted to amputations; here every form of amputation is described, and amongst these methods none is better in many respects than the "hood flap" of Dr. Smith. The last chapter is devoted to the consideration of "compensative appliances," artificial limbs, etc.

In conclusion, we may be allowed to say that Stephen Smith's *Operative Surgery* is one of the most complete works in the English language, and is a fit companion to Malgaigne's magnificent treatise, after which it is patterned. The wood-cuts are in the main good, and are very numerous. The descriptions of operative procedures are plain, and the opinions expressed conservative and judicious. The work reflects great credit upon the author and upon American surgical literature.

2. With Stephen Smith's and Stimson's works already in existence, Dr. Bryant undertook what would have appeared to most persons an almost impossible task—that is, the preparation of a manual of operative surgery which should possess individual merit to such a degree as to give it a place in the surgical literature of the day. We think he has succeeded to a very marked degree. Bryant's manual is not so comprehensive as Smith's work, and is more closely restricted to operative surgery in its more limited sense; for instance, nothing is said of fractures and dislocations at all, except in connection with wiring the patella. As this subject is one of the live questions of the day, we are pleased to see that the opinion of our author corresponds to that of Dr. Smith, which we have already noted. He says: "In my opinion, this measure should not be employed except for other reasons than that of the existence of a simple fracture of the bone, because I do not believe that it is good surgery to expose a patient to the contingencies of suppuration, amputation, ankylosis, and even death, for the better rectification of an injury, which, at its worst, has no tendency to terminate fatally, and almost

invariably results in a serviceable limb when treated by the ordinary methods." What an enormous amount of literature the patella has been the means of creating, and what diverse views have been held in regard to the proper method of treating its fractures! Almost as much a bone of contention have been Malgaigne's hooks, as the operative treatment, and it is rather interesting at this time to note this fact, as there seems to be a tendency to return to this, as Agnew calls it, "infernal machine."

The first fifty-six pages of the book are devoted to general principles, the treatment of operation wounds, the arrest of hemorrhage, and such other preliminary information as is necessary to introduce the reader "in medias res." The consideration of operations upon the bloodvessels takes up seventy-eight pages. The ligation of arteries is carefully considered, the rules for finding the vessels, the linear, as well as anatomical guides, being carefully explained, and, in most cases, elucidated with appropriate plates. We think this section exceedingly satisfactorily treated, even better than the corresponding section in Dr. Smith's book, for the results of the ligation are given in nearly every case by Dr. Bryant, and are not by Dr. Smith. It is stated that the innominate artery has been ligated 17 times, with 2 recoveries. We presume the author would not make such a statement without authority, but a report of the second successful case has never been brought to our notice. Thomas Bryant, in the last edition of his book, says the innominate has been ligated 18 times, with 1 recovery. Statistics of operations upon the bloodvessels performed in pre-antiseptic times are not of much value now, thus 20 ligations of the radial are recorded as having been performed during the war, with 4 deaths, and 10 of the ulnar with 3 deaths, percentages which are out of all proportion to the inherent mortality of these operations, which may be said to be nothing, when they are done with proper precautions.

The subject of cerebral localization is mentioned, but too briefly to be of much practical benefit; this would seem to be an error in view of the advances made within the past year. Nerve and tendon suturing are recommended in appropriate conditions. Of all operations of surgery none have attained such absolute precision in results, with such a small mortality, as osteotomy for the cure of deformities of the limbs; thus, in about 650 supra-condyloid osteotomies for genu-valgum, only 3 fatal cases occurred as the result of the operation.

Chapters VIII., IX., and X. are devoted to operations upon bones, chiefly to excisions, resections, and amputations, which are well illustrated and correctly described, but require no special notice. Considerable space is devoted to plastic surgery, rhinoplasty, etc.; the remarkable case of Dr. Sabine is mentioned, but no cuts given. We think some of the old cuts might have been omitted, as they have been in every work upon surgery for about fifty years, but the osteoplastic formation of the nose performed by Dr. Sabine deserves more than slight notice, and is well worthy of being illustrated in a work on operative surgery. In this case, the bridge of the nose was lost, and it was restored by attaching a finger to the skin of the forehead, after removal of the nail and the denudation of the palmar aspect of the finger to the middle of the first phalaux. After union had taken place to a degree sufficient to insure vitality to the flaps, the finger was amputated about its middle, and the framework of the nose was thus secured. The soft parts of the finger and the contiguous tissues of the face were united at the time the finger was secured to the forehead, and an organ formed which gave the man some semblance to a human being, though it did not make him an Adonis, as we happen to know from personal observation.

In speaking of the operations upon the kidneys, nephro-lithotomy is said to have been performed 6 times, with no deaths; these statistics are certainly quite ancient. Dr. S. W. Gross mentions 21 or 22 operations in his article in this journal, with 2 deaths, which makes the mortality about 10 per cent. for completed operations, and nothing for 24 cases in which an exploratory incision was made in the loin, and no stone was found. Henry Morris also gives about the same results. The author is also in error in regard to extirpation of the spleen, when he says, "it has not proved successful, however, in any instance when practised for leucocythæmia." Unless we are quite mistaken, the spleen has been extirpated for leucocythæmic tumor 20 times, with 1 recovery. It is an operation, however, which is absolutely unjustifiable for this disease; and it seems to us that the results are not very "flattering," when performed for other causes, "being in excess of 50 per cent." The author also leaves us to guess which "results" he means, as he does not state whether good or bad. Amongst the methods for radical cure of hernia is one by the author himself, and it is greatly to be regretted that the description of it is not clear and readily understood. It would also have been well if cuts of the procedure had been given.

In none of these works upon operative surgery do we find any account of the methods of Sonnenburg, Thiersch, or Trendelenburg for the cure of exstrophy of the bladder. There is an effort being made by the German surgeons to perform osteoplastic operations for the cure of this dreadful malformation, and it looks as if better results would eventually be obtained than by the ordinary operations of Wood and Maury.

Notwithstanding the few inaccuracies of statement in regard to the results of certain operations and a few other minor defects, Dr. Bryant has produced a valuable book which is fully up with the times. His views upon doubtful operations are conservative, and to our mind judicious, and his teachings may be followed with safety. The mechanical execution of the work is good, the plates and cuts accurate, and a good index is supplied. We congratulate the author upon having placed a good and useful work upon operative surgery in the hands of the profession. It is not so voluminous as Smith's work, hàving about 350 fewer pages, perhaps not so elaborate or so comprehensive, but it is equally as reliable, and will be almost as useful.

3. Mr. Lane's book is a condensed manual of 276 pages, which is shorn of all superfluous diction to such an extent that only the bare descriptions of the various operative procedures are left, without giving any of the indications for operation, or detailing the results which ought to be obtained. The author in his preface does not state any reason for the publication of this work, and we are left in doubt whether there is "a long-felt want" in England, which a manual of operative surgery will fill or not. The present work is perfectly reliable as far as it goes, but it cannot compare with either of the works mentioned above, and it likewise falls far below Stimson's manual of operative surgery, both in the arrangement of its contents and excellence of its figures.

We have already said that the work is perfectly reliable as far as it goes, and to anyone who wants a book which can be easily carried in the pocket, and who does not desire to read many details, we can commend the present. The descriptions of the operative technique are good, and the anatomical explanations correct, but we do not agree with the author that it is more convenient to refresh our anatomical knowledge by a reference to the plates of Gray or Quain than to have them in the manual.

The particulars in which the work is wanting, in our opinion, are the following: too great condensation of its contents; failure to express any personal opinion as to the respective merits of various operations; the omission of various operative procedures which are now recognized the world over as legitimate, as Mikulicz's, Tripier's, and Hancock's operations upon the foot, gastro-enterostomy, and digital divulsion of the pylorus, excision of the anus, etc., methods which, though not often required, ought at least to be mentioned in a work upon operative surgery. The figures and plates are entirely too diagrammatic, and are made to do service in too many capacities. It may not be necessary to describe the methods of dressing wounds for English readers, but we think this omission an error. The dressing of a wound, the manner of introducing sutures, and the drainage are matters which are more important than the operation itself in many cases, and wherever it is necessary to instruct anyone in the performance of operations, it is equally as important that he should be thoroughly instructed in the dressing of wounds and in the use of antiseptic agents.

4. Dr. Morris's brochure professes to be "a treatise on the subject of antiseptic surgery which can be understood by beginners," but if this statement is correct we must give "beginners" credit for a very superior order of intellect, as we are sure that it will be very difficult for those who are further advanced to understand a considerable portion of it.

In the preface or "First Word" of the author, the candid statement is made that "this book is modest only in its size," a statement which is amply demonstrated by a perusal of its contents. That the author is a man who entertains strong opinions, and is not afraid to express them is very evident, but if there had been as much modesty in expression as there is in the size of the book, we think the antiseptic cause would have been better served. The cause of antiseptic surgery is exceedingly strong and is sure to prevail, and every attempt to popularize its principles and practice is laudable, but its very strength demands a simple presentation of facts rather than a rhetorical display.

Whilst, therefore, we commend the effort to diffuse a greater knowledge of the methods of antiseptic wound dressing, and of the splendid results of antiseptic surgery as compared with those of pre-antiseptic times, we must positively protest against the bombastic and metaphorical style of the present work. There is a kernel of valuable information in regard to surgical dressings, the materials of which they are made, and where they can be obtained; their cost, and the manner of using them, but it is so encased in a thick shell of verbosity, metaphor, and, in some places, incomprehensible diction that its value is very materially reduced. We may be allowed to express the hope that, when a revision of this little book is demanded, the author will prune it of personalities, anecdotes of doubtful applicability, and ambiguity of expression, and will present the very valuable subject matter in plain language, as befits a scientific communication. R. W.

VERHANDLUNGEN DER DEUTSCHEN GESELLSCHAFT FÜR GYNEKOLOGIE. ERSTER KONGRESS.

TRANSACTIONS OF THE FIRST CONGRESS OF THE GERMAN GYNECOLOGICAL SOCIETY. Edited by DR. F. WINCKEL, President, Professor of Obstetrics and Gynecology at the University of Munich, and DR. R. FROMMEL, Secretary and Docent of Obstetrics and Gynecology, University of Munich. Leipsic, 1886.

ONLY last year was a gynecological society formed in Germany, and this volume of three hundred and fifty pages contains the transactions of the first meeting, which was held at Munich, in June, with Winckel, of Munich, as presiding officer. The society commences with a membership of sixty-eight, and among the names are to be found some of the most renowned obstetricians and gynecologists of the world. Among them the Brauns, the Veits, the Freunds, the Schwartzs, Credé, Fritsch, Hofmeier, Martin, Müller of Berne, Breisky, Leopold, Olshausen, Sänger, Scanzoni, Schauta, Schröder, and Zweifel, names familiar in this country.

The transactions of this society will be scanned with interest, as indicating the kind of work that is being done, the direction of professional labor, and the amount of progress being made in a country which has contributed so much to this important branch of medical science.

Looking over the volume, and classifying its contents, we find that of the thirty papers three are upon anatomo-physiological subjects, two upon subjects of general interest, one presenting an electro-lighted speculum, and one, which, with the discussion, occupies twenty-five pages, upon the prophylaxis of ophthalmia neonatorum. The others are equally divided between subjects purely gynecological and obstetrical, and of the latter five are devoted to the puerperal state. So great an attention to obstetrics in a society ostensibly devoted to gynecology, is another illustration of the intimate natural connection between the two branches, and suggests the inquiry whether two subjects touching each other at so many points, and so mutually inter-dependent, can be profitably separated by special societies for each.

Looking critically at the papers, their marked practical character is apparent at once, and is, indeed, their most striking characteristic. With but one exception is there any amount of space devoted to disquisitions purely theoretical. The papers are the record and presentation of practice, and of the writer's experience. The same remark may be made of the discussions, and the fact is very striking when the Cæsarean section is under consideration, from the number of members who give personal experience of an operation which is, in this country, comparatively a rare one.

We select a few of the papers, most important in regard to their practical aspects, for a very brief presentation of their contents.

The first paper is by Müller, of Berne, on the "After-treatment of Severe Laparotomies." The danger of septic infection after laparotomy is now reduced to so low a point as to approach to zero, while there yet remain the dangers from shock, hemorrhage, thrombosis and embolism, tetanus, and disturbances of the function of the bowels. To the last the paper is entirely devoted, and it should have been entitled accordingly.

Disturbed intestinal action of any degree up to complete obstruction, which has frequently resulted fatally, may be caused by exudation around the pedicle in Douglas's cul-de-sac, by adhesion of the intestines to the pedicle, to the line of incision, or by adhesion of coils to each other. For these consecutive accidents the author proposes two remedies: 1, the abandonment of the bandage in all cases in which there are extensive injured surfaces of the abdominal cavity; 2, the introduction of some substance to keep the surfaces apart until healed. Such a substance should be aseptic, harmless, unirritating, and readily removable. It must necessarily be liquid, and Müller believes he finds all the requisites in a seven per cent. solution of common salt. A case is related in which this course was pursued, followed by some severe symptoms, due, the writer thinks, to rapid absorption of a large quantity of liquid; and the paper closes with consideration of means to effect a constant flow of the fluid into and out of the abdominal cavity. Whether worth while to put in force, in every case, a complicated process for the escape of a comparatively rare accident, was not touched upon in the discussion, which gave, nevertheless, several points of much interest. Experience of the speakers plainly showed that such adhesions did not always cause any symptoms, as proved by autopsies and by second operations; also that it is not safe, in a second laparotomy, to go down through the scar of the first; one speaker having, in this way, divided the small intestine in two-thirds of its circumference. Elischer, of Buda-Pesth, and Küstner, of Jena, drew and stitched together the peritoneal edges of the pedicle, thus covering the new surface. The most important point, however, is the influence of different antiseptics in preventing these accidents, and the widely varying experience and views of individuals as to this influence. Thus, Kaltenbach, of Giessen, thinks that these accidents have diminished in frequency under his observation by a more tender toilet of the peritoneum, and by the avoidance of too concentrated antiseptics. At the same time his experience has shown that these adhesions result from circumscribed areas of inflammatory action "due to unsatisfactory asepsis," and he has observed a striking difference since he changed from carbolic acid to corrosive sublimate—1 to 6000.

> "The contrast with disinfection by carbolic acid is very striking. During the time that I used carbolic acid I had two fatal cases of obstruction of the bowels in twenty-four operations, dependent upon circumscribed purulent inflammation with consequent adhesion of intestines. Since I have used corrosive sublimate I have not had a single case of this kind in fifty-four operations."

On the other side comes Saexinger, of Tübingen, with one hundred and thirty-one laparotomies, and a very careful cleansing of the peritoneum, without a case of intestinal complication. Then, again, Krukenberg, of Bonn, has observed intestinal obstruction, and attributed it to the use of a too concentrated solution of the sublimate. The number of cases and strength of the solution are not stated. He has, therefore, abandoned the use of the mercurial antiseptic, and since then has had no accident of this kind.

In direct connection with this subject comes the paper by Elischer, of Buda-Pesth, on "Poisoning by Iodoform after Severe Operation." The writer gives in detail several cases in which severe and dangerous symptoms followed the dressing of wounds with iodoform. These symptoms seem to have been similar to those observed by Treves[1] and described by him as acute iodoform poisoning. The cases might easily have been taken for inflammation of the meninges. There was sudden delirium with excitement and vomiting. In some cases jaundice was present and in others great depression of strength without apparent explanation. Great frequency of the pulse—140—and a pulse out of all proportion to the temperature—pulse 120, temp. normal—seem to have been almost always present. This differs from Treves's observations of a temperature rising to 104°, or even 106°. From these cases the writer believes himself justified in sounding a note of warning as to the free use of iodoform upon extensive wounded surfaces. There is no notice of any cases similar to Treves's chronic iodoform poisoning, nor is any eruption spoken of. One member, however, had observed violent itching of the skin in one case.

The discussion upon this paper is most valuable in two important practical aspects. It embraced the subject of the paper proper and also the curability and operative treatment of tubercular peritonitis. The views of the different speakers are, therefore, arranged and presented under these two heads.

In regard to iodoform poisoning it is to be observed, first, the expression of doubt as to iodoform being always the cause of the symptoms given. Slaviansky, of St. Petersburg, had seen just such a case of disturbances of the nervous system, a constantly rising pulse with a temperature not above 98.4°, and considered it to have been a case of intoxication by iodoform. The autopsy, which was thoroughly made, "gave a perfect picture of septicæmia." Battlehner saw a case of mania following and attributed to iodoform, which, after cure in an asylum, presented a recurrent attack. Chrobak had seen one case in which the symptoms given above were present when no iodoform had been used. Second, while in regard to explanation of the anomalous symptoms there were some voices in favor of that refuge of lacking knowledge, idiosyncrasy, considerable evidence was presented that fatty subjects seem more likely to be injuriously affected by iodoform. Doubtless the theoretical proposition of Chrobak is sound, that, as with ether so with iodoform, the condition of the kidneys should be carefully investigated, and that much depends upon their excretory power. Third, whatever the explanation of the origin of the toxic effects may be, abundant evidence is here adduced that these effects are altogether exceptional in occurrence and that iodoform has been used very freely, and in large numbers of cases without any injurious consequences. To the interior of the uterus it has been repeatedly applied in quantities of six to ten grammes; one speaker says bad symptoms are never caused by less than ten grammes; Chrobak always uses it freely in all laparotomies, injuries of the parturient canal, retention of portions of placenta, has used it in "hundreds of cases" and seen no bad symptoms as a consequence. The positive statement made in this country that "iodoform, in greater quantity than forty-five grains, will give rise to poisoning,"[2] seems, therefore, not to be sustained by this testimony.

The subject of the operative treatment of tubercular peritonitis was introduced by the report of two cases by Frommel, which were treated by laparotomy and "thorough iodoforming" of the peritoneal cavity. Both yielded a brilliant result. During the discussion two other cases of like character were related. But that the recovery in these cases did not depend upon the iodoform was speedily made apparent. One case is reported cured in which the abdomen was sponged out with solution of carbolic acid, and another in which corrosive sublimate was used, the patient dying eight months afterward of phthisis. Two cases were cured by tapping alone, one of them undoubtedly suffering from pulmonary phthisis, which caused death a year afterward, and in one case laparotomy alone removed a very large quantity of fluid which never reaccumulated. In this case there was no part of the peritoneum as large as a small coin (pfenniggrösse) which was not studded with tubercular deposit. Of course, the question of accurate diagnosis as to the character of the deposits was not passed over. In one of Frommel's cases the "papillary excrescences" were evidently "granulation tissue," and that they are not always tubercular, was argued from Spencer Wells's case.[1] Nevertheless, the subsequent death of several of the patients from tubercle elsewhere would seem fairly to prove the nature of the peritonitis which gave rise to the ascites, and in addition the number of cases in which specimens were exsected and submitted to microscopic examination was so great as to leave no shadow of doubt as to their character, despite the position of one speaker that no diagnosis could be satisfactory where the presence of the tubercle bacillus had not been demonstrated. Further than this, it appeared from the experience of members that tubercular peritonitis is by no means the fatal disease it is generally held to be. Not only does it show "a surprising tendency to recover after operative measures," but in many cases it heals spontaneously, or may disappear for years. Two cases of spontaneous recovery are related, the patients dying afterward of phthisis.

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[1] Practitioner, October, 1886. This journal, January, 1887, pp. 246, 277.

[2] Weir: Trans. N. Y. Acad. Med., vol. iv. p. 190.

Sänger opens a paper upon "Simplification of the Cæsarean Section," with the admission that, although with modern use of antiseptics and our increased knowledge of abdominal surgery, the "classical simplicity" of the operation has been forever left behind, yet that it has been made too complicated, and that, to be of service, its technique must not be such as to require the skill of the practised laparotomist, but must be brought within the range of surgeons in general. He therefore lays down the steps and measures of the operation which he now deems essential, as derived from larger experience. He prepares the patient as for any abdominal operation, using carbolic acid or sublimate as disinfectants, and only two assistants besides the midwife, who will care for the child, are required. The anæsthetic may be committed to a layman, a point which was justly protested against in the debate. The incision is made in the median line passing, if necessary, through the navel. The application of pressure-forceps, and the provisional sutures for drawing together the abdominal walls to prevent escape of the intestines, may be dispensed with. The turning out of the uterus before incising it is not necessary, except when the child is dead, or when sufficient assistance is not present to prevent entrance of uterine contents into the abdominal cavity. If the placenta be under the uterine incision, either cut directly and rapidly through it, or peel it off sideways as quickly as possible. In three cases he has pursued the former course once and the latter twice.

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[1] Ovarian and Uterine Tumors, 1882, p 101.

The child is then extracted, and during or after this step the uterus is turned out of the abdomen, the walls of which are drawn and held closely together behind it, so as to prevent all ingress of fluids; the intestines, if escaped, covered by, and the uterus laid on, disinfected napkins; constriction of the cervical portion may be by manual compression, or "by twisting the uterus on its long axis," instead of by the elastic cord. "In the interest of simplicity," the undermining or dissection of the peritoneum, and the resection of the muscular structure of the uterus, have been abandoned. The uterine wound is closed by eight to ten deep sutures passed through everything except the decidual surface, and preferably of soft silver wire, after which from sixteen to thirty sutures of fine silk are passed through the serous membrane, twice on each side, as in the Lembert suture for the intestines. Closure of the abdominal wound is as usual, and the after-treatment "as inactive as possible." An ice-bag is placed on the abdomen as the patient is put to bed. The following are the statistics:

The total number of cases now amounts to 30, with recovery of the mother in 21—73.3 per cent; 27 children saved—90 per cent. Deducting 3 American cases, all fatal, there remain 27 cases for Germany and Austria, with 22 recoveries—81.5 per cent. At the front stands Leopold with 11 cases—10 mothers saved and 11 children. The three clinics of Leipsic, Dresden, and Innsbruck have had, altogether, 19 cases, with 18 mothers saved—94.7 per cent.; and 19 children—100 per cent.

Much of the discussion was taken up with questions of priority and on the relative value of silver and silk for the deep uterine stitches. Sänger allows either, but prefers silver, while some preferred silk, and doubted the safety of silver if the operator is not skilled in fastening it. Schauta advocated the silver suture strongly, and gave the following statistics: Of 17 cases in which silver sutures were used, not one died; while there were 7 fatal cases out of 10 in which silk was used. He justly says that septicæmia could not explain this marked difference. Priority as to Sänger's particular mode of bringing together the peritoneum was denied, but again strongly claimed by him in closing.

Leopold's remarks are of great value, from the large experience upon which they are based, and because in every case he has "sought to place himself in the position of the practitioner, and aimed to attain the greatest possible simplicity and safety of the operation as performed in private practice." He is in favor of turning out the uterus before incising it, and says that this can be done without much difficulty. He also recommends the provisional stitches through the abdominal walls in order to draw them together behind the uterus—a proceeding which he "cannot too strongly recommend." He then puts on the rubber constrictor, fastens it with a clamp forceps, and only draws it up tight after removal of the child. He does not express himself as to incising or peeling off the placenta, but other speakers expressed themselves strongly in favor of going directly through the placenta with the hand, if possible.

However much the value or novelty of Sänger's contributions to the modern Cæsarean operation may be questioned, this much was accorded him here and passed unchallenged: He has rendered the great service of having advocated the old and classic method at a time when all were marching under flying banners in support of the Porro operation. By the extraordinary improved results of the modern method he has widened the range of application of the operation and lessened its mortality.

The operation of shortening the round ligaments for retroflexion is considered in a paper by Zeiss, of Erfurt, entitled "Zur Alexander-Adams'schen Operation." He advocates the procedure, and presents his experience of three cases modestly in view of the "cold and cautious reception given to this operation in Germany." All the three patients are thankful that he has operated upon them, but in neither of them has a year yet elapsed. The paper having opened with a criticism of some objections made by the President in his recently published work,[1] Winckel replies. His objections are purely theoretical and, therefore, such as must yield to experience; the strongest one is that sufficient time has not yet elapsed to test the results. The principal speakers besides, were Slaviansky and Mundé, of New York, both of whom present considerable experience with the operation which gives valuable testimony as to the difficulties of performing it and its results. The former has had sixteen operations; twice the ligaments were not found at all, and five or six times unsatisfactorily; when found the operation was "typical, easy, and brilliant." The latter reported seven cases, the ligaments found in three and not found in three others: in the seventh, found on one side and not on the other. As to results, they seem to be favorable so far as tested. Mundé says: "I believe the operation has a future, albeit a restricted one." Slaviansky's opinion is as follows:

> "I will, therefore, only say of the Alexander operation that it is entirely justifiable for certain selected cases, and for certain forms of retroflexion, the uterus being freely movable; but it is impossible to say in advance whether the operation can be performed or not. It does not, therefore, at present stand on a very wide foundation, and much investigation is yet necessary in order to be able to say how, when, and in what cases it is practicable."

We have preferred to occupy the space at our disposal with a fair epitome of a few subjects of practical interest rather than to attempt a *résumé* of each paper which could but be unsatisfactory from its brevity, or to consider papers in which unsettled questions are discussed rather than addition made to our knowledge. For the benefit of those who may be interested in the subjects, we give the titles of the principal remaining papers, with names of the authors:

Bayer: On placenta prævia.
Fehling: On the relation between the composition of the blood of the pregnant woman and that of the amniotic fluid.
Sänger: On examination of the ureters in woman by the touch.
Winckel: On the doctrine of internal puerperal erysipelas.
Bumm: On the etiology of puerperal cystitis.
Stumpf: On puerperal eclampsia.
Runge: On the general treatment of puerperal septicæmia.
Sänger: On the relations of gonorrhœal to puerperal disease.
Schatz: On ulcers of the female bladder.
Schauta: On the operation for recto-vaginal fistula.
Küstner and Korn: On perineorrhaphy—two separate papers.
Olshausen: On the early stages of myoma clinically considered.
Küstner: On cocaine in plastic surgery.

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[1] Lehrbuch der Frauenkrankheiten. Leipsic, 1886.

Finally, we can but congratulate our medical brethren of Germany on the formation of this Society, and on the excellent showing both as to quantity and quality of the first volume of its transactions. The high expectations excited by the array of distinguished names at the opening of the volume are not disappointed by perusal of its contents.

J. C. R.

SPASM IN CHRONIC NERVE DISEASE. THE GULSTONIAN LECTURES, DELIVERED AT THE ROYAL COLLEGE OF PHYSICIANS OF LONDON, March, 1886. By SEYMOUR J. SHARKEY, M.A., M.B. Oxon., F.R.C.P. London: J. & A. Churchill, 1886.

IN the unpretentious little work, *Spasm in Chronic Nerve Disease,* Dr. Sharkey has taken a general view of the subject of muscular spasm in chronic cases, but he has also collected a fund of clinical material so illustrated with interesting and valuable observations, that he has done much to put in compact form what is now known of a very difficult problem in neurology.

There is nothing so dark in the general obscurity of nervous diseases as the study of the cause of spasm. Hence, to throw light on this branch is, indeed, a work to be commended, and Dr. Sharkey has cause to be congratulated on his selection of a subject for the Gulstonian Lectures. An investigation into the cause of spasm in organic nerve disease is at present highly interesting, in view of the mapping out of the brain into motor centres and sensitive areas, and the general localization of the functions of that organ. Dr. Sharkey divides his lectures under the following heads: (1) spasm in connection with cerebral motor mechanisms; (2) in connection with spinal mechanisms; (3) functional spasm.

In the consideration of the first division of spasms Dr. Sharkey necessarily goes into the discussion of localization of brain functions, and in describing the motor area of the cortex refers to an explanation of a long-observed clinical fact,

> "that in hemiplegia, in connection with disease of the central ganglia, the arm is usually more paralyzed than the leg. For hemorrhages from the branches of the lenticulo-striate artery would, from their position, press more upon the anterior than the posterior division of the motor segment of the capsule, and this is the vessel which most frequently bleeds."

The probable explanation of this is, that the fibres of the arm in the capsule are anterior, and those for the leg lie posteriorly. Dr. Sharkey seems to doubt the exact diagnostic value of knee-jerk and ankle-clonus, etc. This spasm must be studied with regard to the condition of the patient. For instance, Dr. Sharkey says:

> "A man suffering from extreme debility and anæmia came to my out-patient room, and the house physician called my attention to the fact that he not only had very extensive knee-jerks, but as marked knee- and ankle-clonus as I ever saw. He was sent into the hospital, and after two days' rest in bed I was unable to elicit even the slightest clonus."

A most interesting series of cases is given in the first lecture, showing the pathological conditions which produced tremors and spasmodic contraction of muscles. These cases are made more clear by illustrations.

In the second lecture the subject of spastic paralysis is taken up, and some very interesting pathological histories are given. In this lecture, as in the first, the connection between the cerebral system of fibres and the clinical phenomena of spasm is discussed.

The following lecture is devoted to the spinal system and the diseased conditions of that organ which produce the spasmodic contraction of muscle. A short summary of functional spasms, including histrionic spasm, writers' cramp, pianists' cramp, etc., conclude the work, which will be found to be of special interest to all those who study the nervous system or who are interested in physiological pathology. J. V. B.

The Healing of Arteries after Ligature in Man and Animals.

By J. Collins Warren, M.D., Assistant Professor of Surgery at Harvard University. 8vo pp. 184. New York: William Wood & Co., 1886.

Dr. Warren's work on this subject of never-failing interest to the surgeon, though laboring under the disadvantage of following so closely on Dr. Senn's admirable paper on the same subject, will certainly attract much attention.

We find first a very elaborate and complete review of the history of the ligature. This has been so exhaustively treated, comparatively recently by a number of writers, notably by W. Griefenberger, Adamkiewicz, and Senn, that it would be difficult to present anything very new on the subject. The principal conclusions at which the author arrives, partly from numerous ligations performed on dogs and horses, partly from examination of specimens obtained from the human subject, are: First, the length of time required for complete repair—three to six months in larger arteries; second, the influence of traumatism and septic processes on the size of the thrombus, which was usually very small in aseptic cases; third, the very small part taken by the endothelium in the cicatrization; fourth, the complicated character of the healing process, a principal part being taken by a mass of granulation tissue surrounding the vessel, compared to the so-called provisional callus in fractures. This is said to invade and cause absorption of the fibres of the adventitia, causing the wall of the vessel where compressed by the ligature to expand, the granulation-tissue thus invading the lumen of the vessel. Lastly, and this is the condition which will be most freely criticised, the author claims that there is an active proliferation of the muscular cells of the media, and that these play a not unimportant part in the whole process.

With regard to the relative importance of the endothelium and the granulation-tissue formed outside the vessel, a comparison of Dr. Warren's plates with those of—*e. g.*, Raab (*Arch. f. Klin. Chir.*, 1878, xxiii. "U. d. Ent. d. N. im Blutgefäss. n. der Unterbind.")—will we feel sure go far toward convincing the reader that the differences depend on the numerous and often trifling variations in the performance of the experiment—*e. g.*, the extent of the incision, laceration or bruising of surrounding tissue, with, probably most important of all, success or failure in preserving asepsis. Dr. Warren states that in many of the experiments no special effort was made to keep the wound aseptic, and that, as a rule, they healed rapidly in the deeper portions, but a small subcutaneous cavity was almost invariably found containing serum, muco-purulent fluid, or pus as the case might be. Occasionally a small fistula led down to the ligature, and in a few considerable suppuration took place.

Now, in the last two sets of cases always, and in the first at least very often, we are dealing with infected wounds, in which an inflammatory process, very different from mere repair, is going on, an inflammatory process which could very well account for the abundant ensheathing callus, and the extent to which the vessel wall was softened and replaced by connective tissue. It seems to us to impair seriously the value of Dr. Warren's conclusions, at least as applied to cases where no infection occurs, that some pains were not taken to avoid suppuration, or at least the presence or absence of infection noted. That in most cases suppuration did not occur around the ligature, which was generally encapsuled in the callus, will not alter matters greatly for those who have noticed the extent to which bacteria often infiltrate surrounding tissues without necessarily causing them to break down. Smooth, muscular tissue is not always easily distinguished, and the non-participation of the muscle cells in the cicatrization has been maintained by so many excellent authorities with such "singular unanimity," as Dr. Warren himself says, that one is tempted to think that there may be good grounds for such a consensus of opinion.

R. J. H.

THE NATIONAL DISPENSATORY: CONTAINING THE NATURAL HISTORY, CHEMISTRY, PHARMACY, ACTIONS, AND USES OF MEDICINES. By ALFRED STILLÉ, M.D., LL.D., Professor Emeritus of the Theory and Practice of Medicine in the University of Pennsylvania, and JOHN M. MAISCH, Phar. D., Professor of Materia Medica and Botany in the Philadelphia College of Pharmacy. Ninth edition, revised and improved. Imperial 8vo. pp. xv. 1781. Philadelphia: Henry C. Lea's Son & Co., 1886.

THE National Dispensatory is so well and favorably known on both sides of the Atlantic that scarcely anything is left to the reviewer except to call attention to the fact that another edition of this valuable work has made its appearance.

This last edition surpasses even its predecessors in thoroughness and accuracy. The fact that in 1884, when the third edition was published, no revision of the British Pharmacopœia had been made for seventeen years has necessitated a thorough going over of the whole work in order that the references might correspond to the last revision of the work of our British cousins. In addition to these changes is a fairly full *résumé*, in the form of addenda, of the more important drugs which have come into general use in the last two or three years, chief among which may be mentioned antipyrin and cocaine hydrochlorate.

Professor Stillé finds an opportunity, under the headings of antipyrin and thallin, to attack once more the use of antipyretics on general principles, and the whole tone of the article on these two drugs, as well as the references alluded to, is decidedly adverse. While it cannot be doubted that in certain cases antipyrin has produced untoward symptoms and even death, it is also a fact that considering the widespread use of this remedy comparatively few disagreeable effects have been noted.

As to the attack on antipyretics in general it can only be said, with all deference to the opinions of Dr. Stillé, that his statements are arrayed against the opinion of the profession in general in this respect, and that the daily clinical experience of an exceedingly large body of able men still leads them to the use of such drugs.

By far the fullest article on these newer remedies is devoted to cocaine. In the space of eight pages the derivation, history, and medicinal properties of this valuable remedy are quite thoroughly considered, and the drug is spoken of as "a precious discovery." The new basis for ointments, lanolin, receives favorable notice, while menthol and urethan also come in for their share of attention. H. A. H.

De l'Intervention Chirurgicale dans les Affections du Rein. Par Azarie Brodeur, M.D., Professeur a l'Université Laval a Montreal, etc. Avec cinq planches en chromolithographie et neuf figures intercalées dans le texte. 8vo. pp. 576. Paris: G. Masson, 1886.

Surgical Intervention in Renal Affections. By Azarie Brodeur, M.D., etc.

To anyone interested in the surgical affections of the kidney and the operations performed for their relief, this attractive-looking volume, which appears to be based upon a thesis for the doctorate, holds forth, on superficial examination, the promise of a rich intellectual treat. A careful study of its contents, however, shows that the subjects embraced in its pages have, as a rule, been imperfectly discussed, and that it should include conclusions drawn from an analysis of upward of five hundred operations that had been recorded up to the time of its appearance, instead of three hundred and twenty seven cases collated by the author, many of which are incorrect and evidently quoted without consulting the original authority.

The operations for calculous affections are hopelessly mixed. In a table of twenty-five nephrolithotomies are included seven cases which are not illustrations of that procedure at all; while nephrotomy and nephrolithotomy are used as convertible terms for the removal of stones from pyelonephritic kidneys. In his table of forty-four nephrectomies for calculus associated with suppurative lesions, thirteen operations are recorded in which a stone was not present; while his table of nephrotomies for suppurating kidney embraces only fourteen cases, when in point of fact he ought to have collated more than ninety cases. In addition to these serious defects and omissions, he discusses the various operative procedures in four pages, so that this portion of the work is practically valueless.

In concluding this brief notice of a work that has no *raison d'être*, we take pleasure in stating that it has one redeeming feature, namely, the indications for and against surgical intervention are fairly stated, and agree, in the main, with the conclusions reached by recent writers and operators. Thus, Brodeur teaches that nephrectomy should be resorted to only after the failure of other measures for floating, calculous, suppurating, hydronephritic, and cystic kidneys; that it may be practised for carcinoma if the general health is not impaired; and that it is indicated as a primary measure for urinary fistulæ, and sarcomatous and other tumors.

OUTLINES OF THE PATHOLOGY AND TREATMENT OF SYPHILIS AND ALLIED VENEREAL DISEASES. By HERMAN VON ZEISSL, M.D., late Professor at the Imperial Royal University of Vienna. Second edition, revised by MAXIMILIAN VON ZEISSL, M.D., Privat-Docent at the University of Vienna. Authorized edition; translated, with notes, by H. RAPHAEL, M.D. 8vo. xii. pp. 402. New York: D. Appleton & Co., 1886.

THESE outlines of Zeissl's are too modestly named, for his work is a most full and detailed one, and leaves but little for such filling up as might be proper if his subject were dealt with only in outline. Certain critics have remarked that the part devoted to pathology is disproportionately large, and that in which treatment is discussed disproportionately small. We do not concur in this criticism. The fact is, that while there is still room for much debate as to the exact nature of the different venereal diseases—although we have settled convictions in regard to this matter—there is not much room for discussion as to the best methods of treating them.

Zeissl is a dualist, and in his Introductory states briefly and clearly the reasons which to him (and to us) seem to establish conclusively the essential difference between syphilis and other venereal diseases, namely, the venereal ulcer and gonorrhœa. Gonorrhœa Zeissl calls "venereal catarrh," and the venereal ulcer he calls "*schanker*," in his own tongue; or "chancroid," borrowing the French term. We regret that the translator of his work has made use of the term "soft chancre" for the German term "schanker," since we have frequently occasion to observe that, what might seem so innocent, leads to confusion in the minds of those who are not perfectly familiar with the history of modern opinions in regard to venereal diseases. Another error of the translator consists in his translation of the German term "*sklerose*" by "sclerotic ulcer." He is, of course, aware that neither sclerosis nor ulceration is conclusive as to the nature of a venereal lesion, and that the more of the one there is, the less there will be of the other. Many writers in our own language have settled upon the term "initial lesion of syphilis" as the most unequivocal one to apply to what it describes, and we hope that their example may be followed when another edition of the work we are reviewing appears.

We have no space to speak in detail of the teachings of Zeissl in regard to the different manifestations of the venereal diseases, although we may express some surprise that the section devoted to the site and form of the "Hunterian induration" (an ill-chosen term for the initial lesion of syphilis) makes no mention of the urethra. Zeissl has come to the conclusion that extirpation of the initial lesion of syphilis, however early performed, does not prevent the outbreak of later manifestations, and he doubts whether the earliest possible cauterization is of any use.

In regard to the treatment of syphilis, we note that Zeissl considers expectant treatment as suitable to all "recent cases of acquired secondary syphilis," as well as to all cases in which a febrile disease supervenes. If the phenomena of the secondary period resist expectant treatment for eight or ten weeks, treatment with iodine may be commenced, and this is applicable to *all phases* of syphilis. In fact, relapses occur less frequently after an early treatment with iodine than after the use of mercury. Of the preparations containing iodine, the iodide of sodium and the iodide of iron are the best. The latter is especially suited to anæmic cases. Iodoform is also useful in some cases.

We call attention to this point because it has appeared to us that the opinion that iodine is adapted to the treatment of the earliest stages of syphilis, has not secured the practical assent of English- and French-speaking medical men which it deserves. It does not seem to be generally known that Sigmund, in his later years, came to reverse the old theory that mercury was the best remedy for early syphilis, and iodine for its later stages. We are glad to observe that Zeissl states that "Too much stress cannot be laid upon the fact, that even in the gravest forms of syphilis the preparations of iodine alone will often be found sufficient." And, again, "The preparations of iodine are adapted to all forms of syphilitic disease." And, as to mercurials, he says: "The mercurials generally accomplish more if they have been preceded by a course of treatment with iodine."

With this we must close our review. Zeissl's work does not need more praise than it has long since received. As the result of an enormous experience, and of a most thorough study of the subject of venereal diseases, it is invaluable to every syphilographer, and its practical teachings ought to be familiar to every one who undertakes the treatment of venereal diseases.

As a book, this translation is a credit to the publishers, and in the main to the translator. We would suggest, in addition to what has been said above, that it would be an improvement if the prescriptions were translated into the terms of our U. S. Pharmacopœia, and, even if this were not done, that they should be put into correct Latin.

C. W. D.

A TREATISE ON THE DISEASES OF THE NERVOUS SYSTEM. By WILLIAM A. HAMMOND, M.D., Surgeon-General U. S. Army (Retired List), etc. With one hundred and twelve illustrations. Eighth edition, with corrections and additions. New York: D. Appleton & Co., 1886.

THE fact that an eighth edition of Dr. Hammond's work has been called for is sufficient proof of its standing in the American profession, but when the preface of the seventh edition calls attention to the fact that it has been translated into French, and that an Italian translation was at that time going through the press, it is very evident that the first systematic treatise on nervous diseases published in America has commanded decided attention abroad.

Certainly, in point of lucid arrangement and classification, Dr. Hammond's work is an admirable treatise on an important special branch in medicine, and its popularity shows what a demand there is for it both by students and active practitioners. Whatever work may have been done before, and whatever names may have been known in England and on the Continent as prominent in this special branch of medical research, Dr. Hammond was the first in America to collect the material for a systematic work on the diseases of the nervous system, and he performed his task so cleverly that his book, after passing through eight editions, remains practically the same to-day as it was when the plan of it was first conceived. It contains the same classifications and divisions, amplified by fuller knowledge, and made more valuable by the observations of many of his co-laborers in neurology.

Dr. Hammond's book has been so often and so favorably reviewed that it will be unnecessary in the present notice to consider any other than the new portions of the edition. Before, however, referring to these sections, it is due to Dr. Hammond to allude briefly to some important observations which are to be found in the older portions of this treatise.

The term neurasthenia which is so prevalent, and of which most neurologists are so thoroughly tired, is not mentioned, and all symptoms usually included under that head are classed as cerebral congestion. The line of division between some cases of mild melancholia and so-called cerebral congestion is so indefinite that it would seem necessary to describe an intermediate condition which would include the abdominal symptoms of these cases, and especially the series of marked sensations which seem to arise from some disturbance of the abdominal sympathetic system. Exophthalmic goitre is very appropriately included under cerebro-spinal diseases, and the description of this remarkable trouble is both graphic and instructive.

Dr. Hammond still adheres to the consideration of athetosis as a distinct disease, though most observers will agree with Charcot that it is simply a symptom of certain forms of hemiplegia. Any disease of so complicated an organ as the brain must necessarily show many anomalies, and this anomalous consequence either of paresis or paralysis can never be traced as a distinct disease.

Convulsive tremor is the name given in this work to a class of peculiar cases which border between hysteria and epilepsy, and to which Dr. Hammond has been among the first to call attention. No one who has met these obscure and puzzling cases can fail to be thankful for an account of this disease, however imperfect or unsatisfactory it may be. The fact that such conditions may be cured, or, to state it more correctly, may recover can be attested by the writer of this review. Yet any one of limited experience, who is unacquainted with the observations contained in the chapter now under consideration, would be led to think that a favorable result in convulsive tremor is neither possible nor probable. Only lately a case of convulsive tremor has come under the writer's notice which was diagnosticated by a neurologist as one of brain tumor, and death was predicted in a few months, yet the patient improved under appropriate treatment, and progressed within a year to entire recovery.

In the present edition a new section is added on "Certain Obscure Diseases of the Nervous System." Of these diseases, Dr. Hammond says: "Under this head I propose to consider certain affections obviously due to derangement of the nervous system in some one or more of its parts, but which are only known by their symptoms, there being no definite knowledge relative to their exact seat, nor in regard to the essential nature of the existing disturbance." The diseases claiming consideration in this section are tetany, Thomsen's disease, and miryachit, and kindred affections. The first two, though well known, are certainly obscure, but to see this last it seems necessary to travel far, for Dr. Beard went into the wilds of Maine to find the jumpers, and Lt. McLean, of the U. S. Navy, made his observations of miryachit in northern Siberia, and a French observer has noticed a similar morbid condition among the Malays, which is called in that country Latah.

Dr. Hammond says of these curious "nervous manifestations:"

> "I am not able to give any certain explanation of the phenomena of 'miryachit,' or of the 'jumpers,' or of certain of these cases of sleep-drunkenness, which seem to be of like character. But they all appear due to the fact that a motor impulse is excited by perceptions without the necessary concurrence of the volition of the individual to cause the discharge. They are, therefore, analogous to reflex actions, and especially to certain epileptic paroxysms due to reflex irritations. It would seem as though the nerve-cells were very much in the condition of a package of dynamite or nitro-glycerine, in which a very slight impression is competent to effect a discharge of nerve force. They differ, however, from the epileptic paroxysms, in the fact that the discharge is consonant with the perception—which is, in these cases, an irritation—and is hence an apparently logical act, whereas in epilepsy the discharge is more violent, is illogical, and does not cease with the cessation of the irritation."

Dr. Hammond has also added to his treatise by incorporating in it the appendix of Dr. Labadie-Lagrave, which was added to the French translation of a former edition of this work.

The section on "Diseases of the Sympathetic Nervous System" is, with the exception of a few notes in brackets, drawn entirely from this source.

The sections on "Cerebral Syphilis" and the "Symptomatology of Cerebral Lesions" are also translated from the work of Dr. Labadie-Lagrave. The last chapters of the section on "Cerebral Lesions and Cerebellar Diseases," including copious annotations by Dr. Hammond, are probably the most lucid explanations of these subjects that we can find in any general treatise on the nervous system.

A translation of "Conclusions Concerning the Diagnosis of Diseases of the Brain," contained in Nothnagel's work *Topische Diagnostik der Gehirnkrankheiten*, is appended to this section, and these formulated symptoms, together with the preceding chapters, make a most interesting *résumé* of what is now known on the subject of localization of brain lesions. This branch of neurology is now attracting so much attention, and in some directions making such signal progress, that the author has certainly added much to the value of the book by making the discussion of the subject as full and comprehensive as the limits of a general treatise would allow.

Of the numerous works on diseases of the nervous system that have appeared in the last few years, it is not too much to say that Dr. Hammond's is the best in many ways: it is very practical, the style is clear and precise, the descriptions are graphic, and treatment is full and satisfactory. During the fifteen years that the book has been before the profession, much progress has been made in neurology. Many changes have been made, but this last edition will be found to be carefully revised, and fully abreast with the times. J. V. B.

QUARTERLY SUMMARY

OF THE

PROGRESS OF MEDICAL SCIENCE.

ANATOMY.

UNDER THE CHARGE OF

GEORGE D. THANE, M.R.C.S. Eng.,

PROFESSOR OF ANATOMY AT UNIVERSITY COLLEGE, LONDON.

On the Abductor Minimi Digiti Pedis, and the Abductor Ossis Metatarsi Quinti Muscles.

Wenzel Gruber found the abductor ossis metatarsi quinti in 9,25 per cent. of 400 feet, a frequency which is much below that recorded by Wood from the examination of a smaller number of specimens. Gruber makes a distinction, however, between this muscle and the insertion of a slip of the abductor minimi digiti into the fifth metatarsal bone; the latter occurred in 8 per cent. of 350 feet; in one instance the two existed together. A new variety of this muscle is described under the name of *abductor ossis metatarsi quinti circumflexus,* the whole or a part of the tendon winding from the plantar to the dorsal surface of the fifth metatarsal bone in front of the tuberosity, to be inserted into the base of the fourth and fifth metatarsals; it was found in 3.5 per cent. The abductor minimi digiti had a slip of origin from the tuberosity of the fifth metatarsal bone in 6 per cent. A bursa was present between the tendon of the abductor minimi digiti and the tuberosity of the fifth metatarsal in 2.5 per cent. The abductor ossis metatarsi quinti is seldom absent in mammals.—*Virchow's Archiv,* December, 1886.

On the Ophthalmic Artery.

F. **Meyer** was led to investigate the anatomy of the ophthalmic artery by the occurrence of a case of fatal hemorrhage after enucleation of the eyeball. In the orbit which had been the seat of operation, he found the ophthalmic trunk given off from the internal carotid artery and passing into the cavity by the inner end of the sphenoidal fissure, while the lachrymal and supraorbital arteries arose together from the middle meningeal and entered the orbit through the outer part of the same aperture. The supraorbital artery anastomosed with the ophthalmic above the optic nerve. The ophthalmic artery was closely applied to the optic nerve, with which it had been divided.

The detailed arrangement in twenty dissections is given, and the general results of the investigation are as follow:

The number of the named branches, and the order in which they arise are subject to many variations, but the typical arrangement may be thus stated: (1) the central artery of the retina, arising in common with one of the ciliary trunks, more frequently the internal; (2) the external ciliary trunk; (3) the lachrymal artery; (4) a supero-external muscular branch; (5) the supraorbital, giving off the posterior ethmoidal; (6) an infero-internal muscular branch; (7) the anterior ethmoidal artery; (8) the terminal division into palpebral, frontal, and nasal. The posterior ethmoidal artery is sometimes wanting, and the supraorbital is often very small.

In addition to the branches usually described, small offsets are sent forward from the beginning of the ophthalmic artery, or from the internal carotid, to the sheath of the optic nerve; and these anastomose with other recurrent vaginal branches of the ophthalmic trunk; a similar anastomosis is formed by the small branches of the carotid and ophthalmic arteries through the inner end of the sphenoidal fissure.

Deviations from the usual condition in the origin and course of the artery are to be explained by the excessive development of a regular anastomotic channel. Thus, the artery (or an accessory source of supply) may arise from the internal carotid, and enter the orbit through the inner end of the sphenoidal fissure by the enlargement of the above mentioned anastomosis, or from the middle meningeal, infraorbital, or anterior deep temporal artery by means of the normal communication with those vessels.

The ophthalmic artery was found crossing beneath, instead of over the optic nerve in three of the twenty dissections, these numbers being identical with those obtained by Zuckerkandl. This condition may be due to an enlargement either of the anastomosis along the nerve, or of a communication between muscular branches of the trunk. In these cases the normal trunk may either disappear, or it may persist as an anastomotic loop above the nerve, which is then surrounded by an arterial ring.

In one instance the ophthalmic artery was seen passing inward above the superior oblique muscle.—*Morphologisches Jahrbuch*, December, 1886.

On the Primary Optic Centres.

The late Bernhard von Gudden was the first to show, by means of degeneration experiments, that the inferior quadrigeminal and internal geniculate bodies do not give origin to optic nerve-fibres; and his conclusions, which have been confirmed by Fovel and von Monakow, are generally accepted, although they have been, so far as relates to the inferior quadrigeminal body, recently controverted by Bechterew. L. Darkschewitsch now goes further and states, as the result of histological research in the rabbit and dog, that not only do no optic fibres spring from the above mentioned nuclei, but that the same is the case with regard to the pulvinar of the optic thalamus and the external geniculate body. The atrophy of these parts after enucleation of the eyeball is explained as due to the degeneration of nerve-fibres which simply pass through them on their way to the surface. The optic fibres have therefore only one centre, namely, the superior quadrigeminal body, but they are joined in the neighborhood of the external geniculate body by others which spring from the pineal gland and the habenular ganglion, and which appear from physiological experiments to be pupillary fibres. Charcot's hypothesis of a crossing of the optic fibres in the corpora quadrigemina finds no support. Darkschewitsch also finds that the upper quadrigeminal body alone is connected to the cerebral cortex by a distinct tract of fibres, and that no such tracts can be followed to the outer geniculate body or pulvinar.—*Archiv für Anatomie*, August, 1886.

ON THE MINUTE ANATOMY OF THE BRACHIAL PLEXUS.

W. P. HERRINGHAM gives (*Proc. Royal Society*, No. 243, 1886) the results of 55 dissections of the brachial plexus, 32 fœtal and 23 adult. The sources of the several muscular and cutaneous branches are as follows: the numbers 5 to 8 indicating the corresponding cervical nerves, and 9 the first dorsal.

Posterior thoracic, 5, 6, and usually 7. Suprascapular, 5 and sometimes a small root from 6. Anterior thoracic, 6, 7, 8, and 9. Coraco-brachialis, 7, the rest of the musculo-cutaneus from 5 and 6.

Median, 6, 7, 8, and 9; 6 supplies pronator teres, flexor carpi radialis, superficial thenar muscles, and radial finger or fingers; 7 supplies flex. sublimis, occasionally ant. interosseous, palmar cutaneous, and the finger next to 6; 8 supplies flex. sublimis, ant. interosseous, and fingers internal to 7; 9 goes only to ant. interosseous.

Ulnar, 8 and 9; the forearm muscles are supplied by both, the hand muscles by 8, palmar cutaneous branches, 9; dorsal, 8. Internal cutaneous, large and small, 9, the large occasionally also 8.

Subscapularis, 5 and 6; teres major, 6 and often 7; latissimus dorsi, 7 and often 8. Circumflex, 5 and 6; deltoid from both; teres minor, 5 only; cutaneous branch, 5 or both. Musculo-spiral, 6, 7, and 8, sometimes also 5, rarely 9; triceps, 7 and 8, outer head sometimes 6 as well; internal cutaneous branch, 8; short external cutaneous, 6; long external cutaneous, 7; radial extensors, 6, or more frequently 7; radial nerve, 6, or 6 and 7; posterior interosseous, 7, sometimes also 8.

The following laws relating to nerve supply are also formulated:

I. Any given fibre may alter its position relative to the vertebral column, but will maintain its position relative to other fibres.

II. *a.* Of two muscles, or of two parts of a muscle, that which is nearer the head end of the body tends to be supplied by the higher, that which is nearer the tail end by the lower nerve.

b. Of two muscles, that which is nearer the long axis of the body tends to be supplied by the higher, that which is nearer the periphery by the lower nerve.

c. Of two muscles, that which is nearer the surface tends to be supplied by the higher, that which is further from it, by the lower nerve.

III. *a.* Of two spots on the skin, that which is nearer the preaxial border tends to be supplied by the higher nerve.

b. Of two spots in the preaxial area, the lower tends to be supplied by the lower nerve, and of two spots in the postaxial area, the lower tends to be supplied by the higher nerve.

PHYSIOLOGY.

UNDER THE CHARGE OF

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ELECTRIC STATE OF THE HEART ON VAGUS STIMULATION.

A. TALJANZEFF (Moscow) found in the frog and rabbit, with a modified Lippmann's capillary electrometer, that the heart gave no signs of change in its electric state during the stand-still produced by stimulation of the vagus, comparable with the electric changes characteristic of muscle contraction.—*Archiv Anat. und Physiol.—Physiol. Abthl.* Supplement Band, Dec. 1886.

ELECTRIC CHANGE IN THE HEART ACCOMPANYING STIMULATION OF THE VAGUS.

In support of his view that all tissues are innervated by antagonistic (anabolic and katabolic) nerves, DR. W. H. GASKELL brings forward the observation that stimulation of the vagus in the neck of the tortoise causes in an uninjured portion of a strip of the quiescent auricle, when connected with the rest of the animal by the coronary nerve alone, a decided increase of electric *positivity*, just as a contraction is accompanied by a decided increase of *negativity.—Journal of Physiology*, Nov. 1886.

RHYTHM OF VOLUNTARY MOVEMENT.

PROF. J. VON KRIES (Freiburg) made observations in control of the results obtained by Schäfer and Horsley (see last number of this journal, p. 217), and in the main confirms their views. He considers all voluntary contraction of muscle to be of a tetanic nature. Volition never works with a single but always with a series of excitations; the shortest movement not being accomplished without some four or five. The limits in the rate of stimulation are, however, very wide, since the rhythm of vibration is found to vary between eight and forty per second.—*Archiv f. Anat. und Physiol.—Physiol. Abthl.* Supplement Band, Dec. 1886.

REGENERATION OF SMOOTH MUSCLE.

DRS. H. STILLING and W. PFITZNER, doubting the accuracy of Jakimowitsch's researches on the frog and spotted salamander, investigated this question on the muscular wall of the stomach of the Triton tæniatus and conclude: 1 That organic muscle tissue can regenerate itself. 2. The regeneration takes place by a multiplication of the existing muscle-cells by division of the contractile substance. 3. This division consists of a thinning of the cell about the centre of its length after the nucleus had shown the various phenomena of karyokinesis.—*Arch. f. Microscopische Anat.*, Dec. 9, 1886.

PLETHYSMOGRAPHIC RESEARCH ON VASOMOTOR AGENCIES.

Regarding the temperature of a limb as an inadequate guage of its vasomotor variations, PROF. H. P. BOWDITCH and his assistant, J. W. WARREN (Harvard Medical School), made a series of experiments by the plethysmographic method on the vasomotor changes in the hind limb of cats following injection of curara and stimulation of cut end of the sciatic nerve. The greater or less volume of the limb was taken to indicate a more or less dilated state of the bloodvessels.

Curara lessened the size of the limb (*i. e.*, was followed by local vasomotor constriction) if the nerve were cut. The opposite result followed if the sciatic nerve were intact. These facts may be explained by supposing that a general vaso-dilator effect was caused by the drug influencing the centre from which the sciatic was cut off.

Stimulation of the peripheral end of the cut sciatic nerve of the curarized animal was followed by one of three results, viz.:

1. Prompt contraction, followed by more lasting dilatation.
2. Prompt contraction without marked dilatation.
3. Slow dilatation not preceded by contraction.

Of these the first was the most frequent.

It thus appeared that stimulation produced two antagonistic effects upon the bloodvessels of the leg. The first of these, *constriction*, is well marked with rapid stimulation, while a slow rate of stimulation favors dilatation. Owing to the rate of development of the two effects, the antagonistic influences produce their results in succession.

When the nerve had been some four or five days cut, the constricting influence was destroyed and stimulation only caused dilatation, from which it appeared that as a nerve degenerates after section it loses its constricting earlier than its dilating power, or, in other words, vaso-constrictor fibres degenerate more rapidly than vaso-dilators.—*Journal of Physiology*, Nov. 1886.

PEPSINOGEN AND PEPSIN.

Confirming results obtained by the first author, Messrs. J. N. LANGLEY and J. S. EDKINS (Physiol. Lab., Cambridge) find that pepsin is rapidly destroyed by alkalies and alkaline salts. Strength of the alkali solution, suitable temperature, and long period of action, increase the destructive power, while the presence of proteids lessens the rate of destruction.

In the hungry animal the mucous membrane of the stomach contains no pepsin, but only pepsinogen, the forerunner of pepsin, because one per cent. of sodium carbonate destroys little of the efficacy of the watery extract of the fresh organ.

Pepsinogen is rapidly converted into pepsin in the presence of weak acid, but otherwise is fairly stable, and in glycerine extract may remain unchanged for years. The change from pepsinogen to pepsin takes place rapidly during digestion.

CO_2 destroys both pepsinogen and pepsin; the former more rapidly. They are also both destroyed by a temperature of 55°–57° C.—*Journal of Physiology*, November, 1886.

THE INFLUENCE OF VENOUS CONGESTION ON THE SECRETION OF URINE.

DR. JOSEF PANETH, working under Heidenhain, gives some evidence upon this subject, made so important by the causal relation of cardiac and renal disease. After a careful review of the literature of the subject, he describes his experiments in detail. These lead him to conclude that, besides giving rise to albuminuria, the least congestion of the renal veins, under all circumstances, is followed by a diminution in the amount of the secretion, and that an increase of the secretion of the kidney cannot follow venous congestion. From the fact that the injection of diuretic salts (he supposes by raising the blood-pressure in the glomerules) causes reappearance of the flow when it had ceased from venous congestion, the author concludes that Heidenhain's hypothesis as to the mechanism of the cessation of secretion is correct, viz., that it depends on the lessening of the rate of the blood stream in the Malpighian capsules, and not, as Ludwig supposed, on the mechanical compression of the canals by the congested state of the veins, which condition remains unaltered or is increased by the greater flow through the glomerules.—*Arch. f. Gesam. Physiol.*, December 10, 1886.

PERIODIC AND "LUXUS" BREATHING.

In an elaborate paper, illustrated with many tracings, PROF. ANGELO MOSSO, of Turin, gives the results of research on the respiratory movements of man and animals. He points out that a periodicity in the respiratory rhythm is much more common than is generally supposed, and can be produced by ordinary sleep or the action of narcotics. Under ordinary circumstances, the respiratory movements are more extensive and rapid than required by the organism. This "luxus respiration" disappears at high altitudes when the air becomes thinner. When the degree of periodicity becomes more marked, the breathing may be called remittent or intermittent, as in the Cheyne-Stokes respiration. In a dog under the influence of chloral hydrate, the inhalation of oxygen had no effect on the duration of the periodic intervals of cessation of breathing. He considers the view that a continuous relationship between the chemistry and the mechanism of respiration must be abandoned. The different departments of respiratory motion, facial, thoracic, diaphragmatic, etc., are capable of independent action or variation. Although not quite independent, yet the mechanisms of respiratory movement are so far automatic as to be able to surpass the chemical requirements of the organism, the vitality of which is indicated by the activity of the regulating nervous centres. Thus when the excitability of the brain and spinal cord increases, a greater gas-interchange occurs in the lungs than is necessary for the activity of the body, and during sleep the motor mechanisms of respiration indulge in periodic rests, and nervous excitation is lessened without the result of any interference with the chemical changes in the tissues or blood. The periods of variation in the respiratory movements do not correspond with those in the bloodvessels. If a variation be caused during the regular breathing, it is followed by a series of successive variations occurring periodically.—*Archiv f. Anat. und Physiol.* Supplement Band, December, 1886.

INNERVATION OF RESPIRATORY MOVEMENTS.

In an exhaustive paper with extensive literary reference, DR. MAX MARCKWALD (Kreuznach) gives a number of original experiments, in which the movements of the diaphragm are graphically recorded by the direct application of the flattened end of a lever to the under surface of the muscle, through a small opening in the abdominal wall. Among the conclusions to be arrived at, may be mentioned the following:

No respiratory centres can be said to exist above the medulla oblongata, where an easily excited *inspiration-centre*, acting in normal breathing, and a more difficultly excited *expiration-centre*, acting in dyspnœa, are situated.

Automatically the centre can only give rise to respiratory spasms, regular and rhythmical breathing being reflex acts, excited by the tonic action of the vagi in quiet respiration.

Impulses from the higher centres can also reflexly excite regular respiratory movements controlling or compensating those produced by the vagus. When these impulses from the higher centres are partially in abeyance, while the action of the vagus is unimpaired, periodic breathing (Cheyne-Stokes) may appear. Impulses from the skin have probably little effect while the vagal and cerebral channels are intact; but when these are interfered with, the sensory nerves may excite a regular series of respiratory movements.

The afferent fibres of the fifth, superior laryngeal, olfactory and splanchnic nerves slow respiration, and may cause standstill in the position of expiration. The glossopharyngeal do not alter the rate, but can produce slow inhibition.

The normal excitation of the respiratory centre does not depend upon the stimulation of the blood—either its want of oxygen, or excess of carbonic acid—as regular movements continue for some time without circulation; nor can the mechanical theory—the excitation depending on the degree of distention of the lungs—be accepted, as rhythmical movements continue when the thorax is opened and the lungs excised.—*Zeitschrift f. Biologie*, N. F. Bd. v.

MATERIA MEDICA, THERAPEUTICS, AND PHARMACOLOGY.

UNDER THE CHARGE OF

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LOBELINE.

From advance sheets of the *Drugs and Medicines of North America*, for which we are indebted to Prof. Lloyd, we obtain the investigations of DR. BARTHOLOW on the actions and uses of lobeline—the alkaloid of *Lobelia inflata*. Several papers have appeared on the physiological actions of lobeline, but up to the present there have been published no reports on its clinical uses. Lobelia, the crude drug, has been the subject of no little controversy, and much has been said of its practical applications, but wholly from the empirical standpoint.

Lobeline is a liquid alkaloid of a brownish-red color, and it has an acrid taste and a tobacco-like odor. The salts are crystalline, and are freely soluble. The preparation used by Dr. Bartholow in his physiological and clinical research was a solution of the hydrobromate, furnished him by Prof. Lloyd.

In general terms, lobeline is a paralyzer, causing death by failure of respiration. Small doses at first increase the irritability of the reflex centres, and the cutaneous and corneal reflex are considerably exaggerated. As the action proceeds the paralysis beginning at the periphery increases, until finally complete muscular resolution occurs. The end organs of the motor nerves are first affected, then the nerve trunk, and finally the cord; but the muscles preserve their contractility. The pneumogastric terminals are paralyzed, and the heart, after a brief slowing, increases in movement considerably. If the medulla be first divided, when the full effects of lobeline are obtained the heart is arrested in the diastole, its cavities distended. If now a faradic current is applied, the auricle will start in action, but only the basal portion of the heart, and the latter acts much more feebly than the former. As the effects of lobeline develop, and before full paralysis occurs, the vasomotor centre is stimulated somewhat, and the blood-pressure rises a little; but it subsequently declines. Lobeline does not paralyze the heart muscle, and death is due to respiratory failure.

As respects sensibility, there is no action, for the sense of pain is manifested until full paralysis occurs. Locally it has a benumbing effect on the mucous membrane, but this is due to physical conditions, and is not a special endowment of lobeline. Consciousness is preserved until carbonic acid narcosis ensues.

Lobeline appears to be too harsh and depressing to be utilized as an emetic. In the ordinary medicinal doses it does not usually nauseate. One subject, an epileptic, complained of nausea after several days use, but it seemed to be transient. Based on the physiological actions it was tried in various neuroses. As it is not depressing to the heart, it was used in some cases of cardiac asthma, when with difficult breathing there was a rather feeble state of the cardiac action. In this condition, and in pseudo-angina pectoris, it was found to be very useful. Asthma—the neurosis—has been the malady above all others in which lobelia has proved useful. The alkaloid seems to be superior to the crude drug.

It has also proved useful in coughs, especially when they are of a spasmodic character; and as they are necessarily reflex, an agent that lessens the activity of the reflex centres must do good to some extent. Lobeline appears to be an effective remedy as an expectorant so-called.

It has also been used with benefit in epilepsy, chorea, and the spasmodic neuroses generally; but a longer experience is necessary to determine its real value. It can be said only that thus far it promises well.

The dose of the salts of lobeline will vary from $\frac{1}{100}$ gr. to $\frac{1}{20}$ gr. It does not appear to be as actively toxic as nicotine.

Carbonic Acid Inhalation and Rectal Injection.

One of the most remarkable revivals in a therapeutical method that has happened lately, is the administration of carbonic acid gas by inhalation and by rectal injection. The proposers and advocates of this practice apparently suppose it to be a new discovery, or, at least, a novel expedient. So far from being new, it is distinctly a revival of an old suggestion—for Priestly, in his treatise entitled *Experiences of Different Kinds of Air*, alludes to the use of carbonic acid gas by inhalation in phthisis, and Percival (1768), on the *Use of Fixed Air*, proposed its administration by rectal injection. In a recent paper (*Bull. Gén. de Thérap.*, January 15, 1887) Dr. M. Dupont advocates the method of inhalation as more efficient than the rectal injection. If sulphydrogen gas is to be administered, rectal injection may be necessary, for, as Bernard demonstrated, this gas, when thrown into the rectum, escapes by the lungs, and does not act on the nervous centres; but carbonic acid gas which is mixed with the former is the active agent, and, as Dr. Dupont shows, this is more conveniently, as it is more rationally, employed by inhalation, and the results are not less excellent.

Dr. Dupont has used about 150 litres in twenty-four hours. He finds that the gas is antiseptic, and hence is appropriate in the treatment of the septicæmia of tuberculosis; that it is anæsthetic, and hence quiets the cough, allays the irritability of the larynx, and favors sleep; that it lessens waste by checking oxidation, and thus lowers the temperature; and that it stimulates the digestive organs and increases the peristaltic movements of the stomach and intestines.

Alcohol in Acute Febrile Diseases.

In the course of his "Therapeutical Conferences," now publishing (*Bull. Gén. de Thérapeutique*, January 15, 1887), Dujardin-Beaumetz advocates the use of alcohol in accordance with the principles of the great English clinician, Dr. Todd. He observes that, although the first enthusiasm aroused by the theories and observations of Todd has somewhat subsided, there is a general recognition of the great advantages of the alcoholic medication. The indications for its use in fevers are the adynamic state, the extremes of life, and habitual use.

After careful study of the physiological action of alcohol, Dujardin-Beaumetz concludes that it acts in some respects as a tonic, as an aliment, and as an antipyretic—thus formulating an opinion by a combination of the various theories most entertained at the present time. It is an aliment because it undergoes in the organism a more or less complete combustion; it is an antipyretic because the oxidation of the alcohol takes place at the expense of the oxygen of the blood, and thus lessens the production of heat; and it is a tonic because it furnishes the nervous system the elements of force and power.

The principles and methods of Todd, so recently discussed and approved in France, are surely fallen into neglect—into positive oblivion, indeed, on this side of the ocean. They were warmly approved by a section of the medical profession twenty-five years ago, but now the actively stimulating treatment of febrile diseases is relegated to the domain of past errors.

HYPNONE.

In the *Archives de Neurologie* for January, 1887, *acetophenone* is the subject of a critical paper by MM. A. MAIRET et COMBEMALE, based on physiological and clinical researches. Under the name *hypnone*, by which it is now generally distinguished, and which was given it by Dujardin-Beaumetz and Bardet, who were the first to study its physiological actions (*Bull. Gén. de Thérap.*, Nov. 1885; also, *Ibid.*, January, 1887), it has been administered a good deal, but chiefly in France. Dujardin-Beaumetz and Bardet assigned the name *hypnone* because this word is significant of its most important property. Unfortunately, the new remedy, brought forward with no little *eclat*, has not confirmed the confident promises of its projectors. For the most part, it has proved to be inefficient, although not devoid of hypnotic action.

The researches of MM. Mairet et Combemale confirm the opinion of those who hold that *hypnone* is possessed of but feeble hypnotic property. They ascertained that the quantity required to produce sleep in animals is really toxic. Administered in toxic doses they say that it rapidly induces a comatose state which has nothing in common with natural sleep. It is, also, a cardiac and respiratory paralyzer, this effect coming on with the coma. Their clinical observations were made on twenty-two subjects of various mental disorders, the special conditions for which hypnone was prescribed being restlessness and insomnia. In only two cases was a hypnotic action obtained, and in these it was indirect; by allaying unrest and muscular agitation the disposition to sleep was favored.

The facts demonstrate, say they, that hypnone is not a hypnotic, and the physiological investigation gave negative results, as had been the experience of other investigators.

CLINICAL EXPERIMENTS WITH ANTIFEBRIN.

RIESE reports (*Centralblatt für die Therapie*, January, 1887) the results of the use by Professor Fürbringer of antifebrin. It was administered in 30 cases: 10 of acute rheumatism; 5 of typhoid; 2 of pleuritis; 4 of croupous pneumonia, and 9 of phthisis. At first the doses did not exceed 30 grains, but they were increased to 45, to 60, and in 1 case to 120 grains, without any toxic action of consequence. The date and degree of the decline in temperature were not uniform. As in the cases of acute rheumatism the temperature was only slightly elevated, the reduction effected by the remedy was inconsiderable. In typhoid, also, it influenced the fever but little, and in only one case was the diminution of fever maintained longer than the immediate action of the remedy. Very considerable variations were observed in the degree of antipyretic effect in different individuals, especially in the phthisical cases.

The slowing of the pulse corresponds to the decline of temperature. An increased tension of the arteries was usually witnessed. The respiration was also slowed, and lessened in volume, and occasionally some cyanosis of the face and extremities was observed. It never induced dizziness and headache, and, unlike antipyrin, did not cause nausea and vomiting; but, in some instances, improved the appetite. Perspiration was a constant attendant on the decline of temperature, and, when large doses had been administered, it was excessive. In three instances alarming chills accompanied the rise in temperature, and were followed by weakness.

As regards the results obtained from the use of antifebrin, it did not have a specific effect in any of the maladies, except in acute rheumatism. It neither shortened nor modified the violence of typhoid: the cases of pneumonia did no better than those under the expectant plan of treatment. The cases of rheumatism did well under it with one exception. After considerable doses the pain subsides in three days and disappears in five. It must be an exceptionally severe case if the pain has not disappeared by the fifth day. In four of the ten cases relapse occurred, but three of these required only one dose of forty-five grains. In all of these cases the remedy had been discontinued on the cessation of the pain, and the cure was effected with salicylate of sodium, but the patients experienced ringing in the ears, headache, and vertigo which they had escaped when taking antifebrin.

The author concludes that although antifebrin cannot fill the place occupied by salicylic acid in the treatment of acute rheumatism, it is quite possible in many cases to effect a cure with the former without the unpleasant effects produced by the latter remedy.

The effects of antifebrin have also been studied by LÉPINE (*Ibid.*), whose conclusions are as follows: In typhus the effects of antifebrin are similar to those of antipyrin. At the point of minimum temperature, antifebrin does not induce a collapse-like condition of depression, but rather increases the power of the pulse whilst it lessens the number of beats. In severe cases it may cause cyanosis, and lessen the urinary secretion.

Antifebrin is a nervine. The lancinating pains of the tabetic are always calmed as if by magic with one or two doses of eight grains each. It has also been used in neuralgia with success, and in a case of multiple sclerosis it lessened the trembling and improved the patient's strength.

INHALATION OF CARBOLIC ACID IN WHOOPING-COUGH.

PICK, in a late paper (*Deut. med. Wochenschrift*, No. 21, 1886), maintains that the inhalation of carbolic acid gives the best results in whooping-cough. The failures of this remedy which have been reported were due, for the most part, according to Fick, to too great dilution. By means of a special mask which he has made and figured in a paper published three years ago, he administers fifteen to twenty drops of the pure acid, on a roll of cotton, introduced into the mask. The inhalation is carried on for several hours every day, the cotton wad being renewed three times a day. No ill results have occurred, and the duration and violence of the disease notably lessened.

THE EFFECT OF FLUIDS ON FEBRILE HEAT.

PROF. GLAX has recently called attention (abstract in *Bull. Gén. de Thérap.*, Jan. 30, 1887) to the fact that drinking fluids increase the temperature of fevers. During fevers there is retention of liquids, and it is only when the temperature returns to the normal that they are evacuated in quantity. The rise of body-heat is in direct ratio to the accumulation of fluid in the organism, and Prof. Glax has ascertained that the temperature is notably reduced by withholding liquids. He explains this by supposing that the dilatation of the vessels, which is an incident of the febrile process, permits the accumulation of water in the blood, and thus there is a more prolonged contact of the red globules with the tissues, increasing oxidation or combustion.

Phosphate of Lime in the Treatment of the Sweating of Consumption.

Dr. Rebory, in his Thèse de Paris (*Revue de Thérapeutique*, February 1, 1887), maintains that phosphate of lime is the most efficient remedy we have to arrest the sweating of consumption. In many cases the beneficial effects are experienced on the day of its administration. It diminishes or arrests the sweats completely, often for a long time. The special advantages of the phosphate of lime are, that it is not a poison, is easy to administer, is well borne by the stomach, promotes nutrition, lessens the diarrhœa, and can be taken for a long time with decided benefit to the general health.

Vaseline for Hypodermatic Injections.

In a communication, which appears in the *Bul. Gén. de Thérap.* for Jan. 15, 1887, M. le Dr. Meunier, of Lyons, advocates the employment of vaseline as an antiseptic subcutaneous injection. After a course of experiments on animals, he ascertained that the method was perfectly adapted to the same mode of medication in man. Vaseline, he finds, diffuses readily through all the tissues, and the solutions made with it can be employed topically to the skin and mucous membrane, or be administered by the stomach. He insists that chemically pure vaseline be used in making the preparations. The following formulæ are proposed for hypodermatic use:

℞.—Eucalyptol (pure)	ʒss.
Vaseline (chem. pure)	ʒij.—M.

Fifteen grains to two drachms may be administered in twenty-four hours.

℞.—Eucalyptol (pure)	♏20
Iodoform	gr. j.
Vaseline (chem. pure)	℈iv

The dose of this is the same as the preceding.

℞.—Turpentine (pure, prepared according to the method of Berthellot)	℈j.
Vaseline (pure)	℈iv.

Of this, fifteen grains to two drachms may be given each day.

When tinctures of essential oils are to be administered, Dr. Meunier advises that, their purity being ascertained, they should be dissolved in pure vaseline, allowed to stand, and then filtered through two leaves of Swedish filtering paper. The author of these suggestions must refer to liquid vaseline.

Antipyrin in Hemicrania.

Dr. Ungar, in a paper which we find in the *Centralblatt für die gesammte Therapie*, January, 1887, proposes the use of antipyrin in hemicrania, this application of the remedy having been suggested by the similarity of its actions to those of salicylic acid. In some cases, administered when the first prodromes of the attack manifested themselves, it had sufficed to prevent them. In other cases, given during the maximum suffering, it distinctly alleviated the distress. Some were greatly benefited by it who had exhausted all the known remedies previously. In some instances, however, the relief afforded by it in one attack was not experienced in another; and in other cases it was without any value as a remedy. The dose varies from fifteen to twenty grains according to individual susceptibility.

Nitroglycerine in Heart Diseases.

Dr. L. v. Holst (*St. Petersb. med. Wochenschrift*, 30, 31, 1886; quoted by *Centralblatt f. Gesam. Therapie*, January 7, 1887) publishes some clinical experiences in the use of nitroglycerine in neuroses of the heart, valvular lesions, pulmonary œdema, etc. He finds that this remedy is a nervine, and one that powerfully affects the nervous apparatus of the heart. In cases of cardiac feebleness with little or no degenerative changes, the action of nitroglycerine was uniformly favorable. Cases of angina were greatly benefited, and sometimes cured. In all instances of cardiac failure, the organ being free from important degenerative changes, it should be administered instead of nerve and vascular stimulants, as camphor, musk, etc., which have hitherto been used. He mentions typhus and pneumonia, as maladies in which this practice is advisable. He does not regard nitroglycerine as a diuretic, although in many cases he has observed an astonishing flow of urine as a result of its action. This result, he thinks, is due to the vascular changes caused by it, for when the kidneys are alone diseased, it does not increase the flow of urine.

Dr. von Holst advises the use of the alcoholic solution—one per cent. The dose is not a fixed one, and must be varied according to the individual susceptibility, which is very different. Some patients are affected by three drops, others by six drops of the one per cent. solution, and hence it is necessary to begin with one drop and increase the dose until its effects are felt.

MEDICINE.

UNDER THE CHARGE OF

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Investigations Concerning Icterus.

F. Müller contributes to the *Zeitsch. f. klin. Med.*, B. xii. H. 1 and 2, 45–114, the results of an elaborate research upon the disturbances occurring in the intestinal canal in icterus. His method consisted in administering nourishment whose quantity and composition had been accurately determined;

and in ascertaining by analysis of the feces, how much of each class of nutritive substances had been absorbed.

After detailing his experiments, with remarks upon each, case he gives the following *résumé* of his conclusions:

1. In case of obstruction to the entrance of bile into the intestine, the absorption of the starches does not suffer at all; that of the albuminoids is at most only slightly affected; that of the fats is very much interfered with. In total failure of bile, 55.2–78.5 per cent. of the fat contained in the nourishment ingested is passed with the feces; while in health only 6.9–10.5 per cent. thus appears.

2. In the absence of the pancreatic secretion from the intestine, the digestion and absorption of the amylacea are not at all disturbed; though it would seem that those of flesh are a little less complete. An increased amount of fat in the stools could not be detected; and it is doubtful whether steatorrhœa is a symptom of diseases of the pancreas.

3. In diseases of the absorbing apparatus of the intestine (tuberculosis; amyloid disease; disease of the mesenteric glands; enteritis) the absorption of fat suffers much more greatly than that of the other constituents of the nourishment; and the feces exhibit the macroscopic, microscopic, and chemical characteristics of the fatty stool.

4. In healthy persons, as well as in cases of icterus, when the pancreatic secretion has access to the intestine, the fat in the feces appears to be almost entirely decomposed (on the average 84.3 per cent.). In 3 cases, in which there was a closure of the pancreatic duct, or a degeneration of the gland, a much less degree of decomposition was recognizable (39.8 per cent.). It seems, therefore, that absence of the secretion of the pancreas from the intestine produces a *qualitative* and not a *quantitative* change in the fecal fat. Fresh pancreatic juice will disintegrate fat far more completely and rapidly than bacteria will do it.

5. The more complete the absorption of fat in the intestines, the higher is the melting point of the fat in the feces. Fats which melt easily are absorbed better than those of a higher melting point.

6. Needle-shaped fat-crystals in the feces are an indication that the absorption of fat has been interfered with. They occur in icterus, and in other diseases in which there has been imperfect digestion of fat. They consist of free fatty acids, and of lime and magnesia soaps.

7. In cases of simple icterus there is no pathological alteration in the albuminous constituents; and the condition of the neutral sulphur and of the compounds of the sulphur-acids does not differ from that in health.

CYCLIC ALBUMINURIA.

G. KLEMPERER (*Zeitsch. f. klin. Med.*, B. xi., H. 1 and 2, 168) reviews the cases which are, or should have been, reported under this title; adds one of his own, and appends the following conclusions:

Cyclic albuminuria presents characteristic pathological features. It attacks chiefly young persons, and especially males. The patients usually present some nervous (neurasthenic) symptoms; often are troubled by indigestion, and may be somewhat anæmic; but exhibit no signs of Bright's disease.

Indeed, all symptoms except the albuminuria may be absent. Albumen is never to be found in the nocturnal urine, and the degree of albuminuria varies at different hours during the day. These variations appear to obey a certain law, and to follow a definite order in each case; but the hour at which the highest degree of albuminuria is reached, and the cycle as a whole, is not the same in different individuals. The time at which food is taken, and the composition of the nourishment appear to have no effect on the albuminuria; but muscular exercise often, though not in every case, influences it decidedly, and great mental strain appears to have some effect. It is almost certainly diminished by improving the state of the general health. It is prone to disappear temporarily if the patient be confined to bed. Its course is chronic; it is the source of no danger to life. It does not become transformed into severe disease of the kidney, and it may finally greatly diminish or disappear entirely.

THE TREATMENT OF CHLOROSIS WITH SULPHUR.

According to SCHULZ and STRÜBING (*Deutsche med. Wochensch.*, No. 2, 1887, 24) three forms of chlorosis may be distinguished therapeutically: 1st, that which disappears on the simple treatment of an imperfect digestion; 2d, that for which the use of iron is necessary; 3d, that which is unaffected or made worse by treatment with iron. For this form the authors have employed sulphur, on the ground that it is one of the constituents of the tissue. They report a series of such cases treated in this way, and give the following generalizations of the results obtained:

1. In the cases of pure chlorosis in which iron was without effect, the general condition was greatly improved by the use of sulphur.
2. After sulphur had been given for a considerable time, the treatment with iron could be commenced and carried out with good results.
3. In those cases of chlorosis which were complicated by catarrhal or inflammatory conditions of the digestive tract, sulphur was not well borne.

ON LAVAGE OF THE STOMACH IN PERITONITIS.

Encouraged by Senator's employment of this method in peritonitis with excessive meteorism, LEWIN has used it in two instances with excellent results (*Berliner klin. Wochensch.*, 1886, No. 44, p. 763). Both were cases of acute peritonitis following operation for strangulated hernia. Lavage was performed three times daily, and followed by the administration of opium. Immediate relief was obtained, pain and eructation were lessened, and sleep procured. Opium had been previously employed without effect. The washing removed the continually accumulating grass-green masses, and diminished the meteorism.

ON THE CONDITION OF THE URINARY FERMENTS IN BRIGHT'S DISEASE.

It has been already proved that normal human urine contains two ferments which act respectively as do pepsin and trypsin. MYA and BELFANTI (*Centralbl. f. klin. Med.*, 1886, No. 42, 729) have studied the changes which these undergo in different diseases. They determined the amount of each ferment present by allowing them to act conjointly for a certain length of time upon accurately weighed portions of fibrin. The fibrin was then removed from the urine; and with it, of course, the ferments with which it had combined. The digestion was then allowed to proceed in artificially prepared fluids suited for the purpose, the loss of weight of the fibrin estimated, and the quantity of each ferment then easily determined. A large number of cases of various diseases were examined, but no constant results obtained, except in Bright's disease. Of this affection twenty-eight cases were studied, and the ferment resembling trypsin was found to be *invariably absent*, while the uropepsin was usually present. In albuminuria not dependent upon disease of the kidney, urotrypsin always occurred. The writers are of the opinion that this failure of the urotrypsin cannot be due simply to the presence of albumen in the urine, but is directly dependent upon the condition of the kidney itself.

ON PAROXYSMAL HÆMOGLOBINURIA.

BRUZELIUS (*Nordiskt. Medicinskt Arkiv.*, 1886, xviii. 22, 1–37) reports three cases of this affection, which seems to be especially rare in Norway and Sweden, though uncommon everywhere. In each of the three patients attacks of hæmoglobinuria were caused solely by exposure to cold. In one patient chilliness, elevation of temperature, perspiration, urticaria, sacral pains, and icterus were seen as accompanying symptoms. Other observers have reported fatigue as a cause, and some claim that syphilis is the true agent in its production. Bruzelius is of the opinion that the disease is a disorder of the blood, in which the destruction of the corpuscles takes place in the organs of circulation, and not in the kidney only, as Rosenbach believes.

ON THE EXAMINATION OF DIABETIC URINE.

One of the difficulties in the determination of the presence of sugar in diabetic urine is the occurrence of bodies interfering with or responding to the tests for it. In some cases oxybutyric acid destroys the exactness of the quantitative estimation with the polariscope. Being a substance which deviates the polarized ray to the left, it thus neutralizes, to a certain extent, the property of right-sided deviation which grape sugar possesses. LEO (*Deutsche med. Wochensch.*, No. 49, 1886, 869) has recently discovered a substance belonging to the group called "reducing agents," on account of their power to reduce the metallic oxides in alkaline solution. This body is a carbohydrate, has the same empirical formula as grape sugar, dissolves CuO in the presence of alkali, and reduces it on boiling. It does not, however, undergo fermentation, and deviates the light to the left. Its reducing power is about one-half as great as that of grape sugar, and it is necessary to boil for some seconds before the Cu_2O is precipitated. Leo has found this body in three cases of diabetes, but absent in a great many. Its occurrence appears to have no special import, except that it often makes the amount of sugar as determined by the copper test appear much greater than it actually is. The author insists that some other test must be employed to obtain accuracy, and especially recommends that by fermentation.

ANTIFEBRIN IN TYPHOID FEVER.

GRUENEBERG (*Berlin. klin. Wochensch.*, 1886, No. 49, 849) reports his results from the use of antifebrin in numerous cases of typhoid fever. The antipyretic effect was all that was sought. By a dose of 4–8 grains the temperature was usually reduced 3–4½° F. It rose again within the next four hours, the rise being often preceded by a chill. No injurious action upon the intestinal tract was seen. Profuse sweating was very common, but the author has never observed cyanosis or reddening of the skin, as after antipyrin. There was also no sensation of burning, or nausea, or vomiting, as often occurs with the older antipyretic.

CALOMEL AS A DIURETIC IN DISEASES OF THE HEART.

The use of this agent as a diuretic has been known and forgotten. Recently it has been revived by Jendrássik and by Stiller; and MENDELSOHN (*Deutsche med. Wochenschrift*, 1886, No. 45, 796) now adds his experience confirming its value in cardiac dropsy. He found it very useful combined with digitalis, and even sometimes effective where the latter drug alone had totally failed. It was best given in doses of three grains three times a day. Diuresis was induced after forty-eight hours, and the administration of the drug was then stopped. Salivation was never produced. He can give no explanation of the manner of its action.

CLINICAL OBSERVATIONS ON ULCER AND ON CANCER OF THE STOMACH, AND ON GASTRIC HEMORRHAGE; WITH EXPERIMENTAL INVESTIGATIONS ON THE CONDITION OF BLOOD IN THE HUMAN STOMACH.

In consideration of this subject, KORCZYNSKI and JAWORSKI (*Deutsch. med. Wochensch.*, Nos. 47, 48, 49, 1886) detail the examination of 52 cases.

I. *The clinical examination of patients suffering from gastric ulcer.* The œsophageal sound was employed in all cases except where the diagnosis could not be questioned; and the function of the stomach tested in three ways:

1. Aspiration of the stomach after strict fasting. If there be nothing to aspirate, 100 c. cm. of distilled water are ingested immediately before the operation. The contents of the viscus are then examined chemically and microscopically.

2. The stomach, empty of food, is examined by the modified ice-water method with regard to its secretion of HCl.

3. The empty stomach is examined by the albumen method regarding its digestive capability and mechanism.

In case remnants of food from the previous day are found, the organ is thoroughly washed out. In this way the authors think the result of an examination is much more accurate than when the ordinary contents of the stomach are studied, no previous fasting having been enjoined. The presence of HCl was determined by the methyl-violet test, although more reliance was placed on the digestion of a known weight of albumen. The authors confirm the fact that the gastric juice, to be capable of digesting, *must* contain HCl as well as pepsin. In some cases it was necessary to examine the contents of the stomach obtained without previous fasting or lavage.

24 of the 52 cases suffered from gastric ulcer, and in 6 of these the evidences of hemorrhage were discovered solely by the internal examination of the stomach. These 6 are reported at length. In the other 18 the diagnosis rested upon (*a*) the statement of the patient that there had been black vomiting and stools followed by a feeling of weakness; (*b*) the long duration of the disease without outspoken cachexia; (*c*) local results of the pathological process (stenosis of the pylorus; dilatation). In all the cases the secretion was much increased, and a considerable amount of fluid could be withdrawn from the stomach after fasting. This always contained a comparatively large amount of free HCl—larger than in any other disease—even when no remnants were present. The acidity was especially high at the time of a hemorrhage. The mechanical emptying of the viscus was much delayed, and in many cases it was never found entirely empty of food. The excessive thirst and hunger, so often complained of, are due to the great acidity rather than to the ulcer itself. Peptone could be always detected by the $CuSO_4$ test.

Their treatment of *ulcer ventriculi* differed somewhat from that ordinarily advised. In case of a hemorrhage absolute rest in bed for the first two days was enjoined, and a small ice-bag placed over the stomach. Swallowing of ice was only permitted to quench thirst, as it increases the secretion of acid; powders of sod. borat. and ext. opii, with small quantities of Carlsbad water, were given. This diminished the acidity and increased the mechanical action of the stomach. No food or drink was allowed. During the second two days no more ice was given if the bleeding had stopped. The diet was now cautiously increased, but at once reduced if pain was produced; and great care was exercised for three weeks at least. A small amount of stimulant was permitted if there was much weakness. Where there had been no hemorrhage the method was the same, except the strict regimen of the first two days. If there was much dilatation, lavage was added to the means described.

II. *Clinical observation in carcinoma of the stomach.* 28 cases were subjected to an internal examination of the stomach; and in 5 of these, which they report in full, recently effused blood was discovered in this way. In the other 23 the correct diagnosis was evident, although no blood was found. Anæmia was present in nearly all the cases, but without the waxy yellow color so often seen in ulcer. In every instance digestion was retarded, and in many cases the stomach, even after fasting, was overfilled with fragments of food. The secretion examined in the manner described was almost always found to be of neutral or alkaline reaction, mucous in character, and diminished in amount. HCl could be detected in the secretion of only 2 patients; both under 30 years of age. Yet in some cases the copper reaction for peptone could be obtained. The authors think some other substance than peptone produced this result.

The symptomatic treatment of cancer employed by them consisted in the administration of HCl and morphia several times a day on an empty stomach, with acid foods and wine. If fermentation of the ingested food occurred, salicylate of soda and borate of soda were given. Lavage was performed from time to time in cases of dilatation.

Korczynski and Jaworski do not accept the view of Riegel, that the secretions of the cancer destroy the normal juices of the stomach, but rather believe that the absence of HCl, as seen in the mucous catarrh of old persons, drunkards, and others, predisposes to the development of the neoplasm. On the other hand, excessive acidity often produces an ulcer by its action on the mucous membrane.

Their remaining conclusions regarding ulcer and cancer are largely expressed in a diagnostic table of symptoms.

Ulcus.	*Carcinoma.*
1. A high degree of an acid gastric catarrh.	1. Very marked mucous catarrh, except in young persons.
2. Unusually large amount of HCl, and very energetic digestive power of the gastric juice.	2. Complete absence of HCl, and diminution of the formation of pepsin.
3. Blackish-brown coffee-ground vomit, with a smell of peptonized blood, and with destruction of the red blood cells.	3. Light, chocolate-colored vomit, smelling of fatty acids; and with remnants of red blood cells.
4. Appetite preserved, or abnormally increased.	4. Appetite much diminished.
5. Excessive thirst.	5. Usually no thirst; often a desire for acids.
6. Burning, cutting, often pressing pain of great intensity.	6. Dull, continuous pain, with a sense of pressure.
7. Usually no palpable tumor.	7. Usually a painful tumor to be felt.
8. Vomiting in most cases.	8. Vomiting in one-half the cases.

III. *Results of experiments respecting the condition of the blood in the human stomach.* Korczynski and Jaworski have further made some careful studies upon the digestion of blood, both within the stomach and by the secretions freshly removed from it. They found that in digestion outside of the viscus the blood corpuscles preserved their shape for a long time, to a greater or less extent. When ingested, however, they lost their form, for some reason, with extraordinary rapidity. From extended investigation they draw conclusions which corroborate their views obtained from clinical study:

1. That dark-colored gastric contents are probably, but not always caused by the presence of blood.

2. Dark brown material, like coffee-grounds, and smelling of peptonized blood, indicates ulcer. A dirty-gray, or light chocolate-colored substance, with an odor of the fatty acids or vinegar, indicates carcinoma.

3. A red, or red-brown filtrate, perhaps containing red blood cells, points toward a recent hemorrhage.

4. Gastric contents containing blood, which give a filtrate strongly acid with HCl, and of energetic digestive power, are characteristic of ulcer, while a filtrate free from HCl, and not capable of digesting, is characteristic of carcinoma.

5. An effort to produce hæmin crystals must be made, or the iron test for blood employed in all cases where the microscopic examination does not render the diagnosis certain.

6. Hæmin crystals will form spontaneously after several days in matter from the stomach containing blood and HCl.

It must not be forgotten that small effusions of blood may be produced by other means, as from slight abrasions of the mucous membrane by the sound, or from capillary hemorrhages.

The Poisonousness of Cholera Bacilli.

Cantani, in considering this subject (*Deutsch. med. Wochensch.*, No. 45, 1886, 789), says that there are three possible means by which the cholera poison may produce death:

1. *Ptomaine.* A ptomaine may be formed by the vegetative activity of the bacilli in the intestinal canal; and this may be taken up by the blood.
2. *Secretion.* A special poison may be secreted by the bacilli, and in like manner be absorbed by the blood.
3. *Digestion.* The bacilli themselves may act directly as the poisonous agent. In this case it is by their death and digestion in the alimentary canal, and by their being taken up by the blood, that they act injuriously on the system.

The author concludes from his experiments upon animals, that it is probably by the last of these methods that the bacilli kill.

The therapeutic indications are two:

1. To limit the increase of the bacilli in the intestinal canal.
2. To aid in the elimination of the poison from the blood.

To fulfil the first, Cantani recommends very large enemata (2–3 or more litres) of a solution of 3–10 grammes of tannic acid in 1½–2 litres of water, sterilized by boiling, and used hot. He employs a simple irrigating apparatus of his own device, elevated 2–4 metres above the patient. By this means he has been able slowly to pass the injection even as far as the stomach. Antiperistalsis, excited by the presence of the injection, has greater effect than pressure in accomplishing the upward passage of the liquid. The therapeutic results obtained have been most gratifying, especially when the treatment was instituted early. That the tannic acid had something more than a simply astringent effect, the author proved by observing its action upon cultures of the bacilli, whose growth it seemed nearly or entirely to check.

The second indication is met very satisfactorily by the hypodermatic injection of ½–1 litre of a hot saline solution, containing 4 grammes of chloride of sodium and 3 grammes of carbonate of sodium to the litre of warm, sterilized water. This prevents thickening of the blood; and, at the same time, removes the cholera poison from it and from the tissues.

On Primary Degenerative Neuritis.

Kast (*Deutsches Archiv f. k. Med.*, B. 40, H. 1, 41–62) reports four cases of this disease which add to our clinical and anatomical knowledge of its symptoms and peculiarities.

The first occurred in a girl, aged thirteen, just recovering from angina follicularis, and seemed to be an instance of systemic infection from it. The first symptom was a paresis of accommodation. The case was further characterized by a progressive ataxia of the upper, and later of the lower, extremities; disturbances of sensibility, with diminution and retardation of the perception of painful sensations; tearing pains at first, but later no subjective complaints; never any tenderness of the nerves on pressure; atrophic paralysis of the interossei and of the tongue; absence of the faradic, and great diminution of the galvanic electrical contractility; abolition of the tendon reflexes, and gradual development of bulbar symptoms. Nine months after the beginning of the disease the patient died of lobar pneumonia. The post-mortem examination revealed nothing amiss with the central nervous system, but a multiple degeneration of the cranial and spinal nerves.

The three other cases lack the confirmation of an autopsy, but exhibit the clinical symptoms of the disease in question.

The second case occurred in a habitual drinker, and began with optic neuritis. Then followed a feeling of exhaustion, weakness, and formication in the legs; atrophic paralysis of both lower and upper extremities, accompanied by an attack of delirium tremens; multiple swellings of the joints; violent tearing pains, and croupous pneumonia. There was also slight tenderness of the nerves on pressure, with irregularly distributed, complete or partial reaction of degeneration.

The third case was one of puerperal infection with septic endocarditis. Soon there appeared atrophic paralysis in the parts supplied by the ulnar and median nerves, with partial or complete reaction of degeneration, and violent pains in both arms. The nerve trunks were tender on pressure; there was anæsthesia of both hands, and temporary paræsthesia and weakness of the feet. Complete recovery followed.

The fourth case was one of severe neuritis following a subcutaneous injection of ether. Paralysis of the radial nerve, and complete reaction of degeneration followed. After several months recovery took place. A discussion of the symptoms accompanies the report of each case.

CONCERNING A NEW MICROCOCCUS—THE PATHOGENIC AGENT IN INFECTIOUS TUMORS.

Under this title MANFREDI (*Fortsch. d. Med.*, B. 4, No. 22, 713–733) publishes an elaborate paper accompanied by colored plates. The micrococcus in question was found, accompanying that of Friedländer, in the sputum of patients dying of pneumonia after measles. He names it "the micrococcus of progressive lymphoma in animals." He then describes its form and its method of growth upon culture media. It was found to be exceedingly infectious to dogs, rabbits, guinea-pigs, and mice, and this infectious nature seemed to be extraordinarily persistent. The inoculated animals died after seven to twelve days, and exhibited enormous swelling of the spleen and liver, with a deposition in them, and in the lungs, lymphatic glands, and elsewhere, of gray or grayish-yellow nodules. These were composed of granulation-tissue, and belonged to the type of granuloma or infectious granulating tumors. With this were combined the characteristic signs of more or less pneumonia, even when the inoculation had been made in the subcutaneous connective tissue. The organism appeared to diffuse itself by means of the lymphatic system.

ON CHANGES IN THE PORTAL CIRCULATION CAUSED BY OBSTRUCTION TO THE DISCHARGE OF BILE.

In the *Deutsches Archives f. k. Med.*, B. 40, H. 1, 83–93, MARAGLIANO reports five cases illustrating the simultaneous and proportionate development of icterus and enlargement of the spleen, and in which the latter disappeared as the former diminished. There being no other assignable cause for the splenic enlargement, the author believes it must be due to passive congestion; and, after advancing several arguments in support of this opinion, he concludes:

1. That the pressure of the overfilled biliary vessels upon the portal capillaries within the liver hinders, in a purely mechanical way, the discharge of blood from the portal system.

2. That symptoms of portal congestion, such as enlargement of the spleen and ascites, can be occasioned by this obstruction to the emptying of the portal veins.

3. That in catarrhal icterus, and in the icterus of engorgement in general, and especially in the hypertrophic form of interstitial hepatitis, the splenic swelling can be produced in the manner described.

The Clinical Value of Uric Acid Sediment in the Urine.

From 3287 examinations of the urine of 272 cases, made with reference to the occurrence in it of uric acid, and its connection with albuminuria, Mygge (*Nordiskt Medicinskt Arkiv*, 1886, xviii. 33, 1–17) found that no free acid occurred in 2786 examinations of 127 cases. Only 59 patients (262 examinations) exhibited uric acid abundantly at times, and in but 16 of these did its occurrence persist during a week or month.

The sediment was most often found in rheumatic affections and in pneumonia. In quite a number of cases lithæmia was seen coincident with albuminuria. Frequently, too, uric acid appeared as an acute albuminuria ceased; and, in many other lithæmic cases, microscopical examination revealed the presence of tube-casts and of renal epithelium. The author is convinced that there is a very frequent, if not a constant, relation existing between renal affections and the persistent deposition of uric acid in the urine. He is, however, unable to explain the nature of this relation. The albumen may be produced, in some cases, by the prolonged action of the highly acid urine upon the tubules; or in others the precipitation of uric acid may be induced by the morphological elements already existing in the urine coming from kidneys already diseased. Uric acid sediment also seems to bear some relation to the desquamation of vesical epithelium, and to certain forms of incontinence of urine.

The Futility of the Sublimate Treatment of Typhoid Fever.

Gläser (*Deutsches Archiv f. klin. Med.*, Bd. 40, H. 1, 31–41) contributes his experience, which is diametrically opposed to that of Greiffenberger. He gives the notes of twenty-three cases treated with sublimate, and the temperature-curve and pulse-curve of each. The quantity of the drug employed was about 0.3 grm. in divided doses during the twenty-four hours. He thinks it can have no possible action in destroying the bacillus, since it reaches in the blood a dilution of at least 1 in 104,000 in a man of 130 pounds weight. It is also rapidly eliminated from the system, and can therefore have no cumulative action. Gläser's conclusions from his case records are:

That by the use of sublimate the mortality of typhoid is not diminished; the temperature does not return any sooner to normal; the tongue is not made moist: the eruption of roseola not prevented or removed; the general condition of the patient not improved; and the duration of the disease or the liability to relapse not lessened. Thus, of all the claims of Greiffenberger, only that of the harmlessness of this plan of treatment can be admitted.

ON THE INFLUENCE OF VENOUS STASIS ON THE URINE.

Paneth has found that venous engorgement, even of moderate degree, diminishes the amount of urine, and that the administration of some diuretic (saltpetre) increases the secretion, in spite of the congestion. **SENATOR** and **MUNK** (*Centralbl. f. d. med. Wissensch.*, No. 3, 1887, 33) have studied the subject more carefully, and, while confirming both .points, add considerably to the extent of Paneth's observations. They find, namely, that in venous stasis the amount of urine is always lessened, and the per cent. of urea very much diminished. On the other hand, the per cent. of chloride of sodium is not notably decreased, while that of albumen is constantly increased. This condition of the secretion of albumen is undoubtedly an indication that under the influence of the passive congestion the function of the kidney is interfered with, while the behavior of the urea proves that it is the *specific secretion* which is especially injured. The fact that the sodium chloride is not affected shows that this salt is not eliminated by a specific glandular secretion. The production, too, of the water of the urine cannot be called purely the act of secretion by a gland.

CEPHALALGIA PHARYNGO-TYMPANICA.

Under this title, **LEGAL** (*Deutsch. Archiv f. klin. Med.*, B. 14, H. 2, 201–217) reports ten cases of a temporo-occipital headache, etiologically connected with affections of the pharynx or ear. It is characterized by more or less violent paroxysmal pain occurring in the region supplied by the terminal branches of the auriculo-temporal and great occipital nerves; is accompanied by disturbances of sensation in this region, and by tenderness of the nerve trunks on pressure; and is relieved by proper treatment of the coexisting catarrh of the pharynx or middle ear. The pain is described as pulling, tearing, shooting, etc., and between the paroxysms there may be a continuous, dull, painful sensation on the affected side of the head. Bodily exertion, coughing, straining at stool, often increase this feeling. In some cases the patient was unable to bear with comfort the pressure of the lightest hat, and the jarring of his footsteps was painful to him. If attacks came at night, the sleep was disturbed. The left temporal region is the favorite seat of the pain. Hyperalgesia is commonly present. The presence of sensitive points is an additional proof that the affection is of a neuralgic nature. The occipital neuralgia appears to be especially connected with the pharynx, while the temporal pain is more nearly related to some disease of the middle ear. This is usually some chronic, catarrhal trouble, producing symptoms so slight that they are generally overlooked. Yet Legal found that local treatment appropriate for the catarrh of the pharynx and middle ear often cures the headache in a very short time, and this without any anti-neuralgic or tonic treatment. The author thinks it possible that the violent, almost neuralgic headache sometimes accompanying various acute diseases is due to the affection of the mucous membrane which often coexists. He cannot explain in what way the neuralgia is connected with the pharyngo-tympanic catarrh.

On the Significance and Determination of Globulin in the Urine.

R. Maguire (*Lancet*, June 5, and September 18, 1886) discusses the varieties of albumins occurring in the urine in cases of albuminuria, and suggests that an investigation to determine the presence of different kinds, as well as their relative quantities, may lead, perhaps, to practical information, important for diagnostic and prognostic purposes.

The presence of globulin and its proportion to the quantity of serum-albumin has especially engaged his attention. Ordinarily, it seems, both are present in the urine of nephritis, the serum-albumin preponderating. In some cases, however, the globulin is present in larger quantities than ordinary, while, in some cases of what appeared to be functional albuminuria, globulin alone was found. Thus, in four observations on what seemed a case of cyclic albuminuria, as well as in a case of puerperal albuminuria in which the albumin was rapidly disappearing spontaneously, globulin alone was found. Thus a possible common origin for these two conditions is suggested.

For separating the globulin from the serum-albumin he adopts the method of saturating the previously neutralized urine with magnesian sulphate. This neutralization is important, for, if the urine be acid, the serum-albumin will be precipitated as well. The globulin is precipitated in an uncoagulated form, it being subsequently freely soluble in water.

In experiments on artificial ox-blood serum, made by dissolving dried blood-albumin in water, Hofmeister and Kauder (*Arch. f. exp. Path.*, vol. xx. p. 411) found that when ammonium sulphate was added till it formed from 24.1 per cent. to 33.6 per cent. globulin alone was precipitated. When the concentration exceeded 33.6 per cent. the precipitation of serum-albumin began, and when it reached 47.2 per cent. the precipitation of the latter became complete. (A cold saturated solution of ammonium sulphate contains 52.4 per cent. of the salt.)

This method of fractional precipitation has been applied by Hofmeister and Pohl (*Arch. f. exp. Path.*, vol. xx. p. 426) to the separation of the albumins of the urine. It was found that if to a given bulk of urine previously made alkaline by ammonium hydrate, an equal quantity of a saturated solution of ammonium sulphate were added, all the globulin would be precipitated. This, after being allowed to settle for one hour, was filtered, washed with a half-saturated solution of the ammonium sulphate, then with boiling water, and subsequently with alcohol and ether, dried at 110° C., and afterward weighed and ignited.

For a rapid qualitative test they recommend adding the ammonium hydrate to the urine, filtering off the resulting turbidity, and then adding an equal volume of a saturated ammonium sulphate solution.

SURGERY.

UNDER THE CHARGE OF

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RECENT SURGICAL LITERATURE.

The last volume of the *Dictionnaire Encyclopédique des Sciences Médicales* runs from "Peric" to "Perit," and contains the following papers of surgical interest: The article "Perinée," by M. KIRMISSON, is complete and well written, and especially valuable for the full account it gives of the various operations for the relief of rupture of the perineum. The article "Perioste" is one of the most important that has appeared in this great work. The anatomy of the periosteum is dealt with by M. RETTERER, and is exhaustive and original. M. HEYDENREICH, under the title of "the pathology of the periosteum," discusses the part played by this membrane in bone affections, scrofulous gumma, and the whole subject of the regeneration of bone. The elaborate treatise on periostitis is from the able pen of M. Kirmisson.

The next article is on the peritoneum. The anatomy, histology, physiology, and development of the peritoneum are dealt with by M. BARABAN. The monograph will become classical. It is complete and up to date, and abounds with original matter. The subject of peritonitis is only commenced. The treatise will probably occupy the greater part of the next volume.

Éléments de Pathologie Chirurgicale Génèrale, by PROF. BAUDRY (Paris, 1886, vol. i.). This is a small work, the precise object of which is not very evident. The present volume deals with acute and chronic inflammation, hemorrhage, thrombosis, gangrene, ulceration, and injuries in general. The matter is well arranged. Considerable space is devoted to theoretical subjects, but the book as a whole shows no evidence of original work.

Handbuch der Chirurgischen Technik, by DR. MOSETIG-MOORHOF (Leipzig, 1886). This is the first part of what promises to be a very complete treatise upon operative surgery. The first section deals with narcosis and local anæsthesia. The second embraces the whole subject of the general treatment of wounds. This chapter, written in a liberal spirit, provides an excellent review of the present position of this branch of practice. The third section is concerned with what are termed elementary operations, such as arrest of bleeding, use of écraseur, bloodless methods of operating, etc. The volume concludes with general operations upon the various tissues. The work is exhaustive and elaborate, and well illustrated, and if the remaining volumes are written with the same care and ability as the present one the book will probably prove to be the best treatise on operative surgery in recent times.

Die Heilstätten für scrophulöse Kinder, by DR. SCHEIMPFLUG. This work deals with the various establishments for the treatment of scrofulous children in Europe. At least two works upon the same subject have been published within the last eighteen months in France. The present volume has the advantage of brevity. It is at the same time very complete and well up to date. It embraces England, France, Germany, Austria, Italy, Belgium, Holland, Russia, and Denmark. It is illustrated by a few good plates.

Traité de Chirurgie Clinique, by PROF. TILLAUX (Paris, 1886, vol. i.). This is the first volume of a work by the celebrated author of *Anatomie Topographique.* It is very disappointing. The present volume deals with the head only. Within 386 small pages the author discusses injuries and diseases of the head, eye, ear, nose, mouth, and tongue. The various subjects are, of necessity, treated in the most scanty manner. No illustrative cases are given, and in the English sense the work would not merit the title of "Clinical Surgery." It is a systematic treatise on surgery in outline. The illustrations are few and conspicuously poor. The work will not add to its author's reputation.

L'Hermaphrodisme, by DR. DEBIERRE (Paris, 1886). This small work aims at giving a complete account of hermaphroditism. The subject has always attracted more interest in France than in England. The best known cases are described, and are represented by very good woodcuts. It cannot be said that the volume adds to our present knowledge, but the completeness of its scope is no small point in its favor.

Traité des Manœuvres d'Ambulance, by DR. A. ROBERT (Paris, 1886). This is a large work of 630 pages that should exhaust the subject of ambulance. It is illustrated by a vast number of original and most excellent woodcuts.

It gives a complete account of the medical department of the army, of the equipment of the various field hospitals, and of the duties of the different medical officers. Another chapter concerns the general arrangements in the field. A considerable part of the book is devoted to the first treatment of the wounded and the subject of transport. The author appears to have made himself acquainted with every form of ambulance, wagon, and stretcher, and to have exhausted all possible forms of transport, good, bad, and indifferent. A long account is also furnished of the operating chest and its contents. The book is admirably arranged, and gotten up with unusual care.

Traitement chirurgical de la Péritonite, by DR. TRUC (Paris, 1886). The leading point of this little monograph is rendered evident by the motto on its title page, "Ubi pus ibi evacua." The author gives an account of the various forms of peritonitis, and then of the treatment by laparotomy, evacuation of the effusion, washing out of the cavity, and drainage. He gives a number of illustrative cases. The work does not aim at originality. The author's conclusions have long been accepted by the majority of surgeons. As a literary production the book deserves high praise. Perhaps its most valuable feature is an exhaustive bibliography of "the surgical treatment of peritonitis."

Traité des Kystes Congenitaux, by PROF. LANNELONGUE (Paris, 1886). A valuable and exhaustive monograph upon congenital cysts. The first part deals with dermoid cysts, the second with mucoid, and the third with serous cysts. The mucoid tumors are regarded as belonging to the dermoid series.

The anatomy of the serous cysts is very fully given. The author believes that some are altered angeioma, while the majority are of lymphatic origin. The fourth section of the work deals with cysts not included under the above headings—*e. g.*, hydronephrosis, sacro-coccygeal tumors, etc.

Des Luxations Pathologiques, by MM. FORGUE and MAUBRAC (Paris, 1886). This laborious work discusses the whole subject of pathological dislocations, their etiology, pathology, and anatomy. Tho mechanical causes that produce deformity on the various points are fully considered. The authors have produced a very complex classification of pathological luxations, that will probably not commend itself either to pathologists or to surgeons. The work is exhaustive and up to date, but adds little to our present knowledge.

Krankheiten der Nase, ihren Nebenhölen und des Rachens, by DR. G. SCHEFF (Berlin, 1886). This is an ambitious work upon diseases of the nose and pharynx. It aims at being complete, and professes to cover the whole subject of pathology, diagnosis, and treatment. The author attempts—with poor success—to consider, apart from one another, the affections of the nose and of the pharynx. The work is of unequal merit, the best and most exhaustive chapters—and at the same time the least useful—are upon the subject of deformities of the nose and rhinoplasty.

Die Lehre von der Brucheinklemmung, by DR. F. REICHEL (Stuttgart, 1886). A very valuable and original contribution to the subject of intestinal obstruction. The first part deals with an analysis of 160 cases of strangulated hernia. The second part enters fully into the whole of the vexed question of the mechanical causes of obstruction of the lumen of the strangulated bowel. The paper is an elaborate one, illustrated by ingenious original experiments.

Über die Behandlungsmethode der Prostatitis mit besonderer Berücksichtigung der Prostate Hypertrophie, by L. FISCHER (Munich, 1886). The work commences with an account of the various forms of prostatitis, their pathology, diagnosis, and treatment. It then considers prostatic abscess, prostatic hypertrophy, retention from prostatic enlargement, and kindred subjects. A very good account is furnished of these affections, and although the monograph cannot lay claim to much originality, it may be regarded as one of the best works we possess upon the surgery of the prostatic region.

TETANUS.

The nature of tetanus was one of the subjects chosen for discussion at the recent Congrès Français de Chirurgie (*Revue de Chirurgie*, No. 11, 1886). The following is a brief account of the conclusions of the various speakers:

M. VASLIN gave an account of 17 cases with 1 recovery. He regarded the disease as of nerve origin ("une surexcitation nerveuse"). He had injected the blood and urine of patients who had died of tetanus into animals, but no result had followed. He advised perfect isolation and the use of chloral and morphia in large doses.

M. BALESTRERI also considered the disease to be a pure neurosis. He uses tartar emetic, beginning with a dose of five centigrammes (about one grain) and increasing the amount gradually until the patient is taking thirty to forty centigrammes every day. 3 cases were treated by this drug and all recovered; 17 cases were treated with chloral and only 6 recovered.

M. THIRIAR would class tetanus with the infective diseases. He gave details of 4 cases to support his view.

M. MANORY believed the disease to be contagious, but also considered that cold and other climacteric changes were concerned in the etiology.

M. DOYEN considered tetanus to be a form of septicæmia. In fatal cases he had found micrococci in the brain, the liver, and the blood. He considered that they had spread from the wound, chiefly along the sheaths of the lymph vessels and the nerves.

PROF. VERNEUIL argued the hypothesis that the disease has an animal origin and is derived from the horse. He believed that tetanus is always a specific infectious malady, probably conveyed from one subject to another by a specific microbe. He gave facts to support his view that the disease is derived from horses, stating that tetanus is peculiarly frequent in those who attend horses, and most apt to occur after horse-bites. Direct infection from tetanic horses has been proved.

M. LARGER gave illustrations to prove that tetanus is an infectious and contagious disease; while DR. BLANC (a physician from Bombay) considered that the disease is, like cholera, greatly influenced by seasons and climate. He regarded cold and wet as probable factors. He considered that a specific germ may exist, and that infection is conveyed, as in cholera, probably through the water.

DR. HILLER (*Centralblatt für Chirurgie*, 1886, No. 48) claims that there is a certain resemblance between tetanus and heat apoplexy. Both affections are marked by high temperature, and, indeed, some of the highest recorded temperatures have been met with in these two disorders. He considers that the great body heat is due to the muscular contractions, and that the essential feature in treatment should be the withdrawal of some of that heat. He advises that tetanus be treated by cool baths and by antipyrin or thallin in large and repeated doses. The action of the skin should be increased by pilocarpin.

THE TREATMENT OF MALIGNANT PUSTULE.

DR. INDUTNJII (*Russkaja Medizina*, 1886, No. 20) strongly recommends the treatment introduced in 1884 by Scharnowskji. This consists in the hypodermatic injection of a two per cent. solution of carbolic acid. The injections are made from two to three times daily. The sore is covered with a compress of carbolic lotion, and quinine is administered internally. Of six cases treated in this manner, only one died. In this instance the pustule was situated on the lip, and the treatment was commenced too late. The use of a hypodermatic injection of a warm one per cent. solution of salicylic acid has also been attended with good results.

DR. SLESSAREWSKJI (*Ibid.*, No. 30) treats malignant pustule with corrosive sublimate. His paper deals with 63 cases. Of this number, only 2 died. One of the fatal cases did not come under treatment until the seventh day, and the other died on the sixth day of the disease with severe gastro-intestinal catarrh. Of the 61 cases that recovered, 1 was seen on the first day, and 1 on the fifth, 22 came under notice on the second day, 30 on the third day, and 7 on the fourth day.

The pustule was seated upon the face in 6 cases, upon the neck in 21, and upon other parts of the body in 34.

44 of the cases were treated in the following manner: The surface of the pustule is cut away with a scalpel and the raw area is then dusted with corrosive sublimate in powder. Quinine is given internally. A slough forms at the site of the pustule which separates in about ten days. In no instance were symptoms of poisoning produced.

In 11 instances salicylic acid in powder was applied in the same manner, but it is apparently less efficacious.

In 5 cases the pustule was destroyed by the actual cautery, and in one example the carbolic acid treatment (Scharnowskji) was employed.

Drs. Woronzoff, Winoggradof, and Kolesnikoff (*Ibid.*, No. 32) have performed a series of elaborate experiments upon animals with a view of ascertaining the best means of destroying the virus of malignant pustule.

They treated the fresh blood and portions of the skin of animals that had died of malignant pustule, with various disinfecting solutions, and then inoculated healthy animals from the tissues so treated. 0.2 per cent. solution of corrosive sublimate, 5 per cent. solution of carbolic acid, and 4 per cent. solution of salicylic acid, rendered the diseased tissues harmless in a comparatively short time. Chlorate of lime and solutions of tannin and chloral hydrate were useless. Of the disinfectants used, corrosive sublimate was the most rapid and the most complete in its action.

Chian Turpentine in Cancer.

Dr. John Clay (*Lancet*, 1886, vol. ii. p. 720) states that since his first communication on this subject (six years ago) he has treated and cured a number of cases of epithelial cancer by means of Chian turpentine. He gives three typical examples: 1. Epithelioma of tongue. Male, aged fifty-nine. Ulcer of four months duration, the size of a sixpenny piece, and surrounded by much induration. One enlarged submaxillary gland the size of a pullet's egg. Movements of tongue limited. No history of syphilis. Treatment: Chian turpentine mixture (Southall's), 8 ounces; resorcin, 2 drachms. Two teaspoonfuls three times daily. The ulcer to be painted on alternate days respectively with chromic acid solution (10 grains to the ounce), and solution of perchloride of mercury (one grain to the ounce). In three months the gland had disappeared, and the ulcer was healed. A new growth appeared on the opposite side of the tongue, associated with another enlarged gland. These both disappeared under continued treatment. In connection with this case, two questions suggest themselves. Are surgeons familiar with bilateral development of epithelioma in the tongue? What interpretation is to be put upon the fact that the second cancer developed when the patient was well under the influence of the drug?

2. Epithelioma of upper lip. Female, aged fifty-two. No history of syphilis. A fungating indurated growth of irregular outline had occupied the whole of the upper lip and involved the lower portion of the left ala nasi; duration of disease not mentioned. A piece examined under the microscope in the fresh

state showed epithelial nests. At the end of thirteen weeks the mass sloughed out or "separated;" a good cicatrix followed. The microscopic examination in this case is unsatisfactory. The comparative rarity of epithelioma of the lip—and especially of the upper lip—in females must be noted, and also the peculiar extension of the disease in this instance. There is no mention of gland enlargement.

3. Epithelioma of the os and cervix uteri. Age, fifty-four. Watery and sanguineous discharges for several weeks. Emaciated and cachectic. The epitheliomatous growth was the size of a hen's egg. After seven weeks of treatment, the growth had almost disappeared. A complete recovery resulted.

Mr. Bury (*Ibid.*, p. 895) reports a case of cancer of the os uteri (in a patient aged forty-nine) cured by the use of Chian turpentine. Symptoms had existed for six months. He also records an instance of long-standing cancer of the breast that underwent improvement while it was being administered.

Ephemeral Glycosuria in Surgical Practice.

Dr. Redard has published a paper upon this subject in the *Revue de Chirurgie*, 1886, Nos. 9 and 10, the following excellent abstract of which appears in the *London Medical Record* for December, 1886.

Ephemeral glycosuria frequently occurs in surgical practice. It is in some instances accompanied by ephemeral albuminuria, and very often the albumen is replaced by sugar, and *vice versâ.* It is not rare to find that sugar appears in the urine several times in the course of the affection. From the author's experience, ephemeral glycosuria is almost always accompanied by transient polyuria and an increase in the quantity of urea. The quantity of sugar which is proportionate to the gravity of the case varies to a considerable extent in different cases. The surgical affections in which this complication has been observed are extremely varied. It was often noted after slight injuries and subcutaneous fractures, but occurs, the author states, much more frequently and, indeed, almost constantly during phlegmonous and gangrenous affections, anthrax, lymphangitis, and erysipelas, and presents itself in a most marked degree in a great number of cases of suppuration just at the time of the formation of an abscess. The author's cases show that there exists a decided relation between the formation of the pus and the appearance of the glycosuria. In nearly all the cases of phlegmon, erysipelas, and septicæmia observed by the author, sugar appeared in the urine just as the temperature of the body was suddenly elevated. The affections in which ephemeral glycosuria has been most frequently observed are those of a septicæmic character. It is held that in the great majority of cases reported in this paper, the condition of the urine was a true ephemeral glycosuria, analogous to the ephemeral albuminuria recently observed in the course of certain medical affections. There was no history of diabetes. Of many patients who were observed from time to time after cure of the surgical affections, not one presented glycosuria or any other sign of diabetes. It is necessary, however, in order to distinguish ephemeral glycosuria from true diabetes, to continue for some time the daily examination of the urine. In attempting to account for the appearance of sugar in the urine at certain times in the course of some surgical affections, the author suggests that the impression produced at the periphery by a cutaneous inflammation, or some other local morbid condition, might be transmitted to the vasomotor fibres contained in the splanchnic nerves and so cause hyperæmia of certain organs, especially the liver and lungs, and accelerate the transformation of glycogen into sugar, thus giving rise to glycosuria. By this theory might be explained also the instances of ephemeral glycosuria and albuminuria that have been observed in the course of some medical affections and after irritation of the skin. Glycosuria, when occurring at an advanced stage of certain surgical affections in association with congestion of the lungs, might be considered as asphyxic and due to the phenomena of insufficiency of oxygenation of the blood. The author would rather admit that the asphyxic blood acts as an irritant and excites the liver to discharge a larger quantity of sugar into the circulation. This irritation may act directly on the liver, but more likely is transmitted by the great sympathetic of the vagi nerves from the cerebro-spinal nervous system. In concluding his paper the author states that these numerous theories might explain ephemeral glycosuria, but that none of them are entirely satisfactory and applicable to every case. Too much at present remains unknown for a complete solution of the problem.

The Treatment of Cold Abscess.

Dr. Andrassy (*Brun's Beiträge zur klinische Chirurgie*, Bd. ii. S. 311) advises the treatment of cold abscess by means of injections of iodoform. He injects the following mixture into the abscess cavity: Iodoform 10 parts, glycerine 50 parts, water 50 parts. He makes two or three injections, as a rule, at intervals of about fourteen days, and obtains a cure by this means in from four to five weeks.

He has treated 22 cases of cold abscess by this injection, and in 20 a speedy and a perfect cure followed. In no instance were any of the phenomena of iodoform poisoning produced. The method appears to be well adapted for large abscesses.

The Treatment of Varicose Veins.

Surgeon-Major Stevenson (*Lancet*, 1886, vol. ii. p. 709) gives his experience of the treatment of varicose veins by the injection of carbolic acid—a measure advocated by Mr. Watson Cheyne.

The treatment consists in the injection of one minim of pure carbolic acid at different situations into the enlarged veins, having previously cut off the circulation from the limb by means of an elastic bandage placed above the highest point of puncture. Injections of pure carbolic acid, one minim each, are then made into the veins at about one inch and a half apart—as many as may be required for each case. A little pledget of absorbent carbolized cotton-wool is placed over each puncture as the needle is withdrawn, and well soaked with collodion; this is allowed to remain until, in the course of time, it falls off, when healing will usually be found completed. The elastic bandage should not be removed in less than fifteen minutes after the last injection has been made, and great care should then be taken not to remove it suddenly. For at least a week after the operation the patient should not assume the erect position or put his foot to the ground for any purpose whatever. The pain is very slight and no anæsthetic is required. "I have done," writes the author, "as many as eighteen injections in one case; and it seems to me advisable to begin with the injection next to the elastic bandage—that is, the one highest on the limb. Getting the point of the needle well into the vein is not quite so easy a matter as might at first appear; attempts to do so at right angles to it frequently fail, and the injection is thus made into the surrounding tissue. The best plan is to fix the skin over the vessel by means of the left thumb, close below the point selected for puncture, and to direct the needle through the skin and coats of the vein in the long axis of the latter. I should think that, in my cases, somewhere about ten per cent. of the punctures caused suppuration, a little abscess about the size of a pea forming where this occurred; but this process, as the result of the caustic action of carbolic acid, was curiously slow and almost absolutely painless."

Dr. Stevenson has treated eight cases by this method with in each instance a certain and permanent good result. On theoretical grounds the procedure should involve some risk. It may be a question also, whether the results will always be so satisfactory as the small number of cases show.

Strong arguments must be adduced to persuade surgeons to abandon the certainly most successful operation of excision for these cases.

Dislocation of the Hip.

Professor Humphry (*Lancet*, 1886, vol. ii. pp. 1011, 1247) has published a most important paper on this subject. He deals with the dorsal dislocation, and founds his remarks upon the detailed dissection of three specimens and upon certain experiments upon the cadaver. "I think," he writes, "it is certain that in each of these three cases the head of the femur passed out of the acetabulum, not at the notch where the capsular ligament is weakest and the resistance to its escape is least, but further back, opposite the tuber ischii, at the part where the rent in the capsule radiates in three directions, and where, accordingly, the first strain upon the capsule must have been greatest. In the first and second cases this was just below the level of the obturator internus and the gemelli. In the third case it must have been rather higher —*i. e.*, beneath the obturator internus, the tendons of which were torn away from the muscle by the force of the head of the bone thrust out beneath it. All three cases were, in short, examples of direct dislocation, and in none of them was the cotyloid ligament or the margin of the acetabulum injured. It has been maintained, upon sufficient grounds, I think, that the dislocations of the hip backward are always, or almost always, indirect, that the head of the bone escapes from the acetabulum close to the transverse ligament, and is then, if the limb be in an inverted position, carried backward and perhaps upward. Furthermore, it is held that the accident occurs during the abducted position of the limb. I quite grant that the capsule is weakest and least supported by muscles in this situation, and that dislocation is easily caused here, in the dead body, by forcible abduction of the limb. But it is to be remembered that the capsule is weakest here, because in the living body it is least liable to be strained in this direction."

Professor Humphry maintains: 1. That the position of the rent in the capsule, through which the head of the bone escapes from the acetabulum, is not at the lowest part, but at the lower and back part, behind the pubo-femoral ligament. 2. That the dislocation occurs commonly when the limb is adducted, flexed, and inverted, and not when it is abducted. 3. That the dislocation is direct, and not indirect. Professor Humphry states that in most recorded cases the limb appears to have been in the position of adduction at the time of the accident, and that the method of reduction by manipulation supports his view as to the course followed by the bone in its escape.

MR. HENRY MORRIS (*Ibid.*, p. 1165) directly confutes Professor Humphry's conclusions, and maintains that the rent is in the lowest part of the capsule, that the dislocation is indirect, and that it really occurs when the limb is in the position of abduction. Mr. Morris believes that the recorded cases demonstrate that the accident most commonly happens when the limb is in the position named, and that the method of reduction by manipulation supports his conclusions.

Mr. Morris does not differ—except upon the question of the position of the rent in the capsule—from Professor Humphry upon the anatomical data of the lesion, but he cannot accept the interpretation placed upon these facts. The two papers furnish the most valuable contribution to this subject, and the weight of evidence so far appears to incline to the side taken by Mr. Morris.

GANGRENE OF LIMBS.

DR. SCOTT LANG (*Edinburgh Medical Journal*, January, 1887) has published a paper with this title, "To Ascertain whether Gangrene is likely to Follow Severe Injury of a Limb." The author recommends the following method: "Gently raise the limb, and keep it raised for two or three minutes, in order to empty it to some extent of blood. Then apply a tourniquet or piece of elastic webbing on the proximal side of the injury, and keep it applied for about a minute. Lower the limb, remove the tourniquet, and, if sufficient circulation remains, the part beyond the seat of injury will blush very red, and will show in an unmistakable manner the condition of the bloodvessels."

GASEOUS TUMORS OF THE NECK.

DR. PAUL FABRE (*Gaz. Méd. de Paris*, 1886, p. 373) reports the following cases: (1) A female child, aged two and a half months, had bronchitis. On the third day a swelling was noticed in the right supraclavicular region. There had been no injury. The tumor had all the characters of an emphysematous swelling. It was increased by coughing, and also during crying. As the cough subsided the tumor slowly disappeared. The author surmises that the swelling was due to rupture of the thyro-hyoid membrane, a diagnosis that does not commend itself.

(2) A male child, aged one month, with a congenital tumor in the front of the neck. The tumor contained air, and subsided quickly and entirely at each inspiration, swelling out again at each expiration. It was the size of a goose's-egg, and was covered with normal integument. The upper part of the sternum was absent. Indeed, no part of that bone could be made out above the level of the fifth costal cartilage. The first ribs appeared to have joined across the median line. It is evident that the wall of the trachea was deficient. The clavicles were normal. The author concludes with an account of other reputed cases of cervical tumor containing air.

M. Giraud (*Revue de Chirurgie,* No. 11, 1886), under the title of "Trachéole," reports the following case: A woman, aged forty-one, was stabbed in the neck with a knife. The stab was deep and involved the air-passage. The wound healed well. After cicatrization the patient developed a cough, and under the scar a tumor containing air slowly made its appearance. It was on the left side, was the size of an orange, and had the shape and site of a goitre. It was barely to be seen during inspiration, but at once swelled out on coughing. It was evidently due to hernia of the tracheal mucous membrane, and communicated with the trachea. To the paper is appended an exhaustive account of the reported examples of aërial cervical tumors.

Mr Wheeler (*Dublin Journal of Medical Science,* November, 1886) reports, under the title of "Pharyngocele," the following remarkable case: A man, aged fifty-seven, suffered from recurrent attacks of bronchitis, laryngitis, and tonsillitis. On lying down he was troubled by a sense of choking, as if a solid mass occupied the throat. His speech was indistinct. He suffered from intense fits of coughing and dysphagia. A tumor existed in the right submaxillary region, that varied in size and was tympanitic on percussion. It proved to be a diverticulum formed from the pharyngeal mucous membrane. The swelling was exposed, a piece of the wall of the hernia-like cul-de-sac was removed, and the wound thus made closed by sutures. The patient made a speedy and complete recovery. Mr. Wheeler believes this to be the first case of pharyngocele cured by operation.

TONSILLAR CALCULI.

Prof. Terillon has published (*Archives Générales de Médecine,* August, 1886) an elaborate paper upon the subject.

The subjects of tonsillar calculus are liable to repeated attacks of sore throat, associated with much œdema of surrounding parts, and ending in abscess, with usually the discharge of some concretions.

The persistence of these attacks and their frequent repetition should suggest calculus, and the stone can often be detected at the bottom of the ulcer left by the bursting of one of the abscesses.

The calculi are hard and white and often deeply imbedded; their early removal is important, and effected without difficulty.

INTRAGLANDULAR EXTIRPATION OF GOITRE.

In the place of total extirpation of the thyroid body, Dr. Garré (*Centralblatt für Chirurgie,* No. 45, 1886) advises the shelling out of the degenerated portion of the gland. In many examples of goitre the disease occurs in the form of circumscribed masses, each of which is separated from the healthy thyroid by a more or less defined capsule.

The capsule is recognized by its regular outline and pale, bluish, transparent wall. Dr. Garré acknowledges that these masses may, especially when deep, be difficult to find, and their removal may involve a deep wound in the vascular thyroid. When once discovered, they are readily shelled out by the finger or some blunt instrument. The bleeding is said to be of no great moment. The cavity left after the extirpation of one or more of the masses is drained.

The operation has been performed in fifty cases by Professor Socin with good results, and without the danger and deformity that attend the removal of the entire gland.

THE PATHOLOGY OF THE THYROID GLAND.

MR. VICTOR HORSLEY (*Lancet*, December, 1886) gives an account of this body that bears in an important manner upon the surgery of the part. He shows that the gland is an excretory, or, rather, a metabolic organ, without being provided with the usual duct of such organs. It also possesses some sort of hæmapoietic function, since the number of red blood-disks in the efferent vein is greater than their number in the afferent artery. Whether the gland exercises any power of forming the fluid portions of the blood must remain at present a doubtful matter. It appears to be a maker of corpuscles only. Mr. Horsley believes that the relation of the thyroid gland to the brain is an apparent and not a real one, and experimental evidence is adduced to prove this position. An adult fox terrier, from whom one lobe of the thyroid gland was removed, was submitted to experimental excitation of the cerebral hemispheres after the expiration of a period of 271 days. An adult black-and-tan dog was similarly the subject of an experiment 109 days after removal of one lobe of the thyroid. Also a bonnet monkey, 84 days after a similar operation. The motor centres of each of these animals were exposed under precisely similar conditions. Excitations with the faradic current were made to each motor part of the hemisphere in each animal, and with the result that no difference could be detected on the two sides. The period of latency, tonic spasm, and clonic spasm—epileptic motor phenomena—were precisely the same whether the right or left hemisphere was stimulated. It was clear then that removal of the one lobe of the thyroid had exerted no detectable influence over the nutrition of the motor cerebral centres on the same side.

Mr. Horsley states that there is no experimental or clinical evidence that the thyroid gland is represented in the cerebral hemispheres. The gland receives from the medulla oblongata sympathetic fibres, which pass down the cervical part of the spinal cord as far as the eighth cervical nerve, and then leave the cord and proceed upward in a direction almost parallel to their former direction in the cord, and are distributed to the glands along the arterial vessels. The gland appears also to receive nerve fibres from the recurrent laryngeal nerve, which are probably derived from the motor nucleus of the spinal accessory.

In order to place on an experimental basis the subject of innervation of the gland, Mr. Horsley performed two experiments on dogs. In each dog an inch of the recurrent laryngeal nerve was excised on one side. One dog was kept alive nine and the other eleven months. But there was no histological difference to be detected between the lobes of the thyroid in either case.

The following experiments, to illustrate the comparative pathology of the thyroid, are interesting.

The suggestion is made that where the glands and acini are small, functional activity is slight. One experiment was made on a donkey. The thyroid gland was excised in August, 1885, and the animal died in 205 days. The chief symptoms for two months were emaciation and weakness; the mental hebetude, if any, was difficult to gauge; the temperature of its body was but slightly lowered. In March, 1886, when the weather became severely cold, nervous symptoms suddenly supervened, and tremors were observed for three days, chiefly in the muscles of the head and neck. On the fourth day these were complicated by constant twitching; the animal became so weak as to be unable to stand, and the body temperature became markedly lowered. Later still, muscular rigidity was observed, and also the paralysis increased, especially in the jaw. On the fifth day of the cold weather the donkey became much worse, and died in the morning. This experiment seemed to show that the gland in the donkey was of but relatively little importance, and the case also brought out very clearly the malignant influence of cold when the thyroid gland was inactive or had been altogether removed. Two experiments had been made in sheep, which have a comparatively good-sized thyroid gland, but though the operation was performed in October, 1885, the animals were still well. In two pigs, the removal of the thyroid was followed by characteristic symptoms of tremors, leucocytosis, and anæmia, with subnormal temperature.

RUPTURE OF THE BLADDER.

SIR WILLIAM MACCORMAC (*Lancet*, December 11, 1886) contributes an account of two cases. In both the rupture was intraperitoneal. The author draws attention to the rarity of the accident, and to the great mortality that attends it, and gives an excellent account of the literature of the subject.

The first patient was a man, aged thirty-five, who was struck violently on the abdomen. He walked home—a distance of 250 yards. The symptoms were vomiting, pain, strangury, with inability to pass water. The man was sober, and had emptied his bladder an hour and a half before the accident. He was admitted fifteen hours and a half after the injury. A catheter was passed, and one and a half ounces of blood and urine drawn off. Laparotomy was performed. The rent in the bladder was on the posterior aspect, was median and vertical, four inches in length, and extended from the superior fundus to the recto-vesical cul-de-sac.

Sixteen silk sutures—involving the serous and muscular coats—were introduced according to Lembert's method; and six catgut sutures that involved the peritoneum only. The peritoneal cavity was washed out with a solution of boric acid. A glass drainage tube was introduced, and a catheter tied in the bladder. The operation was performed under antiseptic precautions, and occupied two hours. The patient made an excellent recovery.

The second case was that of a man, aged thirty-seven, who fell a distance of eighteen or twenty feet, in a sitting posture, upon soft clay. The man was sober, and the bladder had been emptied one and a half hours before the accident. Laparotomy was performed twenty-seven hours after the injury. The rent was two inches in length, and was placed obliquely on the upper and posterior part of the bladder. Fifty ounces of serum and urine escaped from the peritoneal cavity. The case was treated in the same manner as the above, twelve sutures being employed. The patient made a rapid recovery.

Both patients were fat, heavy men. In neither was there any collapse. Sir William MacCormac gives an account of the various operative procedures that have been devised and practised for the relief of this injury.

Drs. Brown and McGill (*Ibid.*, Nov. 20, 1886, p. 971) record two examples of rupture of the bladder. The first patient was a man, aged twenty-six, whose bladder gave way while straining at stool. A catheter was passed, and four ounces of urine drawn off with some blood-clot. A trocar was introduced midway between the umbilicus and pubes, through which much urine drained.

The day after the accident the bladder was opened by a median perineal incision, and a drainage tube introduced. The man died shortly after the operation. The post-mortem revealed peritonitis, and a small rupture—capable of admitting the forefinger—was found at the posterior surface of the bladder, outside the peritoneum.

The second patient was a man, aged fifty-four, who was knocked down when running. He had been drinking. A catheter drew off a quarter of a pint of bloody urine. On the fourth day after the accident laparotomy was performed. A large rent was discovered in the posterior wall of the bladder involving the peritoneum. The viscus was brought into better view by distending the rectum with an air tampon. The bladder wound was closed by sutures. The patient died next day.

Dr. Armstrong (*Ibid.*, Nov. 13, 1886) records a case of recovery. The patient was a girl of sixteen, who fell from a window into the street. She was much collapsed, was severely bruised, and was found to have sustained a fracture of the astragalus and of other bones. Bloody urine was drawn off by catheter. An irregular rent, four inches long, was found in the anterior wall of the vagina involving the bladder. This wound was at once carefully closed by sutures. The patient made a sound recovery. Dr. Armstrong regards the case as an example of rupture of the empty bladder by indirect violence.

Litholapaxy in Male Children.

Surgeon-Major Keegan (*Lancet*, 1886, vol. ii. pp. 1068 *et seq.*) gives an account of 58 litholapaxies performed on boys at the Nidore Hospital, Central India. The ages of the patients varied from one and three-quarters years to fourteen years. The size of the lithotrite used was between No. 7 and No. 11. The stones were of all kinds. The heaviest weighed 700 grains. It was a uric acid stone with a nucleus of oxalate of lime and a covering of phosphates. The patient was nine and a half years of age; symptoms had existed for two years. The operation was performed at one sitting and occupied 182 minutes. The lithotrite was introduced twenty-six times. The patient was in the hospital ten days and made a good recovery. Other stones weighed 360, 344, and 285 grains. In only one instance did death follow. The operation was successful in 57 of the cases. Dr. Keegan greatly prefers litholapaxy to lateral lithotomy for male children. Lithotrity he justly condemns. He examines the objections to litholapaxy in children, the chief being the smallness of the bladder, the narrowness of the urethra, and the great sensitiveness of the genital-urinary mucous membranes. He states, in answer to these objections, that he has never found the size of the bladder an obstacle to the operation, and he does not think that he has ever damaged the mucous membrane of the urethra or bladder.

With regard to the calibre of the urethra, Dr. Keegan states that he has never found any difficulty in introducing the instrument. The meatus may often have to be incised, but the canal itself is much larger in boys than is supposed. As a rule, the urethra of a boy from three to six years of age will admit of No. 7 and No. 8 lithotrite (English scale); while the urethra of a boy of eight or ten years of age will admit a No. 11, a No. 12, and even sometimes a No. 14 lithotrite.

In one child, aged two, a No. 7 lithotrite was used and a No. 9 catheter. In another child aged one year and nine months, a No. 7 lithotrite was employed.

The paper enters into details of the chief cases, and forms a most valuable and practical addition to this branch of operative surgery.

A NEW METHOD OF EXPOSING THE KIDNEY.

PROFESSOR KÖNIG (*Centralblatt für Chirurgie*, 1886, No. 35) advises the following operative procedure. The incision is carried at first downward from the last rib to a point a little above the iliac crest and near the outer margin of the erector spinæ. It is then directed upward in a curved manner as far as the outer border of the rectus muscle, about the level of the umbilicus.

The muscles exposed by this double incision—which is increased in extent when necessary—are next divided and the kidney exposed behind the peritoneum, which is stripped from it. If it be desirable for any reason to approach the kidney from the abdominal cavity, the peritoneum is divided along the course of the oblique anterior incision. If the kidney so exposed contain pus, it is advised that the wound in the peritoneum should be closed when the organ has been freed and before it is cut into.

The author gives two examples of this latter procedure, both of which were successful. One concerned a case of renal calculus, the other a suppurative pyelonephritis. After the kidney has been dealt with, various layers of divided muscle must be united by sutures in their proper order. In order to facilitate this step, Professor König advises that a suture be passed through each divided muscle as it is incised. The sutures are retained for three weeks and the patient kept in bed for at least four weeks after the operation.

HEPATIC SURGERY.

DR. GEORGE HARLEY (*Brit. Med. Journ.*, 1886, vol. ii. p. 899) gives an account of an operation he terms "hepatic phlebotomy." He points out that neither cutting nor leeching the abdominal parietes can have any direct effect on the amount of blood present in an inflamed liver, since no direct communication exists between the bloodvessels of the abdominal walls and those of the hepatic organ.

He advises the direct tapping of the liver to relieve certain cases of engorgement and inflammation: and draws attention to the harmlessness of this operation in healthy animals. He gives the case of a woman of intemperate habits, aged thirty-eight, who was suffering from severe hepatitis with dropsy. The patient was anæsthetized and the upper part of the liver was pierced from right to left with an eight-inch trocar of a diameter between a No. 2 and No. 3 English catheter. Twenty ounces of blood were allowed to escape, the trocar having been driven in up to the hilt. An excellent result followed. He also advises puncturing of the liver capsule as a remedial measure in cases of chronic congestive hypertrophy, and gives examples of this mode of treatment.

Mr. Knowsley Thornton (*Ibid.*, p. 901) gives details of a series of cases of operation upon the liver including the evacuation of hepatic abscess, of suppurating hydatid cysts, and the removal of gall-stones. In one case of non-suppurating hydatid cyst, the cavity was sponged out with tincture of iodine and allowed to close.

Mr. Willett (*Ibid.*, p. 903) reports a case of cholecystotomy in a woman, aged fifty-two. The incision was three inches long and was made in the right semilunar line. The bile-duct was found occluded by a chronic inflammatory stenosis. The gall-bladder was distended, but contained no gall-stone, neither was any growth found in its vicinity. Its walls—after opening—were stitched to the abdominal parietes. The patient recovered with a biliary fistula.

Mr. Howard Marsh (*Ibid.*, p. 905) deals with a case of hepatic abscess in a boy aged eleven and one-half years. The abscess was opened and drained and the edges of the wound stitched to the abdominal wall. Thirty-six ounces of pus escaped. The patient recovered with a biliary fistula.

Mr. Lawson Tait (*Ibid.*, p. 905) reports a remarkable series of 50 cases of operation on the liver. In 7 exploratory incisions were made, the cases being chiefly instances of tumor of the liver. In 13 instances laparotomy was performed, for the most part for the relief of hydatid cyst. In the remaining 30 cases the operation of cholecystotomy was carried out. Out of this number of 50 cases, only 2 died of the operation. Details are given of some of the more important examples.

M. Poulet (*Bull. et Mém. de la Soc. de Chir.*, Paris, t. xii. p. 129) reports one case of hydatid cyst of the liver treated by operation. He advises incision in the place of puncture, the removal of as much of the sac as possible, and stitching of its margins to the edges of the divided peritoneum.

Operation for Fecal Accumulation.

Dr. P. Morris (*Brit. Med. Journ.*, December 18, 1886) reports this case.

The patient, a woman, aged twenty-four, was the subject of intestinal obstruction due to the above cause. The symptoms were chronic. Hard masses were felt in the abdomen. The rectum was blocked with feces, the removal of which led to no improvement. Enemata were unavailing. Vomiting became distressing, and the patient much emaciated.

The patient being anæsthetized, the whole of the tissues of the anus back to the coccyx were divided, in order that the hand might be freely introduced into the bowel. By the side of the hand a long tube was passed, through which warm soaped water was injected. Dr. Morris thus continues: "At the top of the pelvis I came across the big mass which I had so often felt and vainly attempted to remove; but now I could easily crush it. The arm was now withdrawn, when the whole was expelled. After reintroducing the arm I found that the colon was in a very abnormal condition, because, instead of there being an ascending, transverse, and descending colon, it was one tremendously distended chamber, and with my whole arm introduced up to the axilla, I could, on account of her great emaciation, investigate and manipulate every part of the abdominal cavity, with the other hand externally. Strange to say, in the neighborhood of the right iliac fossa I found an oval opening large enough to allow the passage of a good-sized plum (an inch and a half long), with a well-defined margin. This was plugged with a lump of hard fecal matter, which was removed and crushed." Dr. Morris supposes this opening to have been the ileocæcal valve. The colon having been well cleared out, the perineal wound was sutured. An excellent recovery followed.

There is no clear evidence to show that the colon was arranged as Dr. Morris assumes. If the colon be distended, it will become enlarged in both its transverse and longitudinal axes, and will probably measure not less than six feet. This distance can hardly have been traversed. Dr. Morris appears to have explored and evacuated a very large sigmoid flexure, the summit of which when distended may reach to the diaphragm. The deformity of the colon alluded to is not familiar to anatomists, and the opening supposed to be the valve was of unusual dimensions. The operation was admirably planned and carried out.

Intussusception with Malignant Disease.

Dr. Kulenkampff (*Centralblatt für Chirurgie*, No. 47, 1886) reports the following case: A woman, aged thirty-nine, had suffered from partial obstruction of the bowels with a bloody discharge from the anus for six months. In due course a mass, considered to be a polyp, could be felt in the rectum. This proved to be a papillomatous (and probably malignant) growth that took origin in the sigmoid flexure, and had led to an invagination of that part of the colon into the rectum. The entire mass, together with the intussusception, was removed through the rectum. An adherent coil of bowel was accidentally wounded, and the wound was closed by sutures. Symptoms of obstruction set in, and on the tenth day after the operation laparotomy had to be performed and an artificial anus made on the left side. The patient recovered, but with a fecal fistula.

The following recent papers may be noted:

"Hemorrhage from the Innominate after Tracheotomy," by Dr. Hutton (*Brit. Med. Journ.*, December 4, 1886, p. 1102). A boy, aged one and a half years. Operation for laryngitis of three weeks standing. Death from bleeding on the twelfth day. An ulcer was found on the anterior wall of the trachea, at the level of the lower end of the tracheotomy tube, that had opened the innominate artery.

"Acute Peritonitis Treated by Laparotomy," by John Taylor (*Brit. Med. Journ.*, December 18, 1886, p. 1212). Female, aged twenty-one. Recurrent febrile attacks with left iliac pain following labor. Seven weeks after labor, acute general peritonitis. Laparotomy. A burst pelvic abscess found. Abscess sac removed, peritoneum washed out. Recovery.

"Bacteriology in its Relations to Surgery," by Henry Power (*Lancet*, 1886, vol. ii. p. 1111). This paper, delivered as the Bradshawe Lecture, gives a masterly exposition of the present state of our knowledge on this subject. See also "Microörganisms in Relation to Surgery," by Dr. Heuston (*Dublin Journal of Med. Science*, January, 1887).

"Resection of the Knee," by M. Lucas-Championnère (*Revue de Chirurgie*, January, 1887). A report of eleven examples of the operation performed in adults. Ten for tubercular arthritis, and one for arthritis deformans. In all an excellent result followed. The paper is illustrated by figures of the special splints and drainage tubes used.

"Hydatids in Bone," by Professor Müller (*Beitr. zur Klin. Chir. Tübingen*, 1886). Case of hydatid cyst in the humerus. An analysis of forty-three recorded cases, with a full account of the clinical history, prognosis, and treatment of this rare condition. A valuable monograph.

"Extroversion of the Bladder," by M. Richelot (*L'Union Médicale*, October, 1886). A useful description of the procedure known as "Le Fort's modification of Wood's operation."

"What Constitutes Malignancy?" by Herbert Snow (*Lancet*, 1886, vol. ii. pp. 719, 770). The author enters largely into the microscopical anatomy of malignant tumors, and concludes with these words: "Briefly to sum up what I have said, the phenomena of malignancy result from conditions which irritate normal protoplasm, cause it to proliferate abnormally, and to assume quasi-independent parasitic vitality. These conditions may be mechanical; in a much larger proportion of cases they are neurotic."

"Acute Glossitis," by Dr. Totherick (*Lancet*, 1886, vol. ii. p. 724). A report of two cases. The patients were males, ages twenty-one and twenty-seven. The attack appears to have been of spontaneous origin in each instance. The cases occurred in the month of July. Dr. Totherick gives an account of the literature of the subject and of the symptoms of this rare disease.

"Rupture of Synovial Membrane of Knee," by M. Pruvost (*France Méd.*, 1886, No. 85). Man, aged forty-five, with gonorrhœal rheumatism. Great distention of knee-joint. During abrupt movement in bed sudden disappearance of swelling and pain. Supposed spontaneous rupture of synovial membrane.

"Traumatic Tetanus Cured by Removal of Cicatrix and the surrounding Parts," by Mr. Cotterill (*Lancet*, January 1, 1887). Man, aged thirty-nine, wound of thumb with broken glass. Tetanus on twelfth day; chloral, potass. bromide, eserine, etc., had no effect. Scar and parts around excised on the twenty-second day of the tetanus: immediate improvement and recovery.

"Surgical Mishaps," by Pridgin Teale (*Lancet*, January 1, 1887). 1. Disappearance of tumor after ineffectual attempts at removal. 2. Chronic inversion of uterus: attempted taxis: laceration of vagina into Douglas's pouch. 3. Wound of popliteal artery and vein during an operation for necrosis. Recovery without gangrene.

"Lipomata of the Hands and Digits," by M. Poulet (*Revue de Chir.*, 1886, No. 8). An account of all the recorded cases of this rare affection, and of the difficulties in the way of diagnosis.

"Congenital Dislocation of the Patella," by Dr. Bessel-Hagen (*Deutsche med. Wochens.*, 1886, No. 3). Three examples of this very uncommon condition, with an account of thirteen other recorded cases. The bone was displaced outward. In some cases the luxation was incomplete; in others, complete and permanent; in a third series complete in the flexed position only.

"Actinomycosis in Man," by Dr. Moosbrugger (*Centralblatt für Chirurgie*, December 25, 1886). An account of ten recent cases and an analysis of the details of no less than seventy-five recorded examples of this disease.

OPHTHALMOLOGY.

UNDER THE CHARGE OF

L. WEBSTER FOX, M.D.,

OPHTHALMIC SURGEON TO THE GERMANTOWN HOSPITAL, PHILADELPHIA.

Extraction of Soft Cataract by Injection.

In 1884 Dr. A. McKeown introduced to the members of the British Medical Association a method of extraction of soft cataract by intracapsular injection of water. In the *British Medical Journal* for January 15, 1887, Charles G. Lee cites six cases operated upon by himself with highly satisfactory results. The method employed is briefly as follows: The operation is preceded by the usual cataract incision at the corneo-scleral margin, and an iridectomy; then a reservoir of water (pure water, not an aseptical solution) is held by an assistant at varying heights above the patient's head, according to force of the stream desired. A simple rubber tubing connects the reservoir with the terminal which conveys the fluid to the parts desired. The terminal is introduced well in the capsule, often right across the area of the pupil to the lower edge of the iris, or wherever cortical matter was seen. It was most interesting to watch the pieces of cortex slowly floating up, sometimes from behind the iris toward the incision, then to escape with the outgoing stream.

Dr. Wicherkiewicz, of Posen, has adopted the principle, and Mr. Edgar Browne spoke favorably of the method as a valuable aid in removing sticky cortex.

Ciliary Correction of Corneal Asymmetry.

In *Annales d'Oculistique* for September and October, 1886, Dr. Georges Martin brings a wealth of clinical support to the thesis of the preceding month. (See *The American Journal of the Medical Sciences* for January, 1887, p. 267.) The most noteworthy practical conclusion is the author's recommendation that when corneal astigmatism is small the total correction may be given at once, but if it is of a medium or large degree it is best to begin with spectacles correcting only the manifest astigmatism, and as the ciliary muscle becomes habited to the new conditions the more complete correction may be successively added until the total astigmatism is neutralized by the lenses. This presupposes an understanding on the part of the patient of the changes to be made, and the assurance that the glasses will be worn without interruption.

In a subsequent chapter the author tabulates and discusses 70 cases in which the ciliary correction of the corneal astigmatism does not stop with the neutralization, but passes over into a condition of over-correction. This, of course, rarely happens; 45 cases occurring out of 3000 examined. The extent of the over-correction runs from 0.25 to 0.75 D.; though exceptional instances run higher. The corneal astigmatism was generally 0.25–0.5 D. The ophthalmometer is alone capable of differentiating the diagnosis. If the over-correction is a recent production, the author advises the persistent use of atropine for a month; if this fails to break up the over-correction, it may be deemed as permanent, and cylindrical glasses given according to the subjective examination. For chronic cases this is done at once.

ENUCLEATION AND EXENTERATION.

PROFESSOR SCHWEIGGER'S lecture before the Berliner medicinischer Gesellschaft, on the above subject is published in the *Berliner klinische Wochenschrift*, of December 13, 1886. The operation of exenteration is held to be preferable to enucleation in cases where ruptures and wounds of the cornea and sclerotic are of such a nature that suppurative choroiditis and atrophy of the globe are inevitable. In other cases of suppurative choroiditis with inflamed and swollen orbital tissues exenteration is also advised. In sympathetic ophthalmitis resection of the optic nerve is considered better than either enucleation or exenteration. Since 1863 there have been twenty-four fatal results of enucleation, though none have happened in the lecturer's practice, who confesses that he has resorted to the *hässlichen operation* as little as possible. A most urgent and praiseworthy warning is given against the too common haste of enucleation in cases of intraocular tumors. "The more uncertain the diagnosis, the quicker is enucleation proceeded with."

The method of operation in exenteration is to divide the conjunctiva at the corneal margin, excise the cornea, and disembowel the globe with a sharp spoon, leaving only the scleral shell. The conjunctival edges are then sewed together. The time required for healing is greater than in enucleation. A serviceable stump must not be expected, as in a few months the sclerotic will atrophy and shrink to a small and useless relic.

PARASITICAL DISEASES OF THE EYE.

PROFESSOR ZEHENDER'S Bowman Lecture before the meeting of the Ophthalmological Society of Great Britain (*The Lancet*, Dec. 4, 1886) reviews those ocular affections that are caused by parasites and microörganisms. Concerning *Filaria loa*, or Guinea worm, the learned lecturer speaks of it as only existing in the eyes of negroes; but the reviewer has been told by missionaries that it infests the eyes of Europeans living in western Africa as well, and we now have a worm three inches long taken from an American gentleman who had lived many years in Guinea. Dr. Reading, of Woodbury, N. J., removed the parasite from the right eye of the patient.

Concerning cysticerci, it is incidentally explained why so many more cases are found in North Germany than in more southern countries." It is because the cysticercus with hooks, the first stage of the tapeworm infesting the human digestive tube, has its habitat in the hog, and pork is more largely an article of diet in North than in South Germany. The successful extraction of thirty in forty-five cases by Alfred Gräfe, of Halle, from 1877 to 1885, is emphasized as proof of the advisability of the procedure; the opening, preceded by a large iridectomy is made through a scleral wound just outside of the corneo-scleral margin.

Of echinococcus hominis, rarely found outside of Iceland, there are at present reports of about forty cases. The antiseptic method of Lister is approved, and phlyctenular conjunctivitis, purulent ophthalmia, trachoma, saccus lacrymalis, ulcus serpens, keratitis-hypopyon, and keratitis-mycotica are attributed to microörganisms.

Concerning trachoma, besides the standard remedies, the author speaks approvingly of the method of "squeezing, cutting, or scratching out the follicles," as having proved itself useful, and "bacteriologically quite correct."

ETIOLOGY OF CONSTITUTIONAL DISEASES OF THE EYE.

In the lecture of TWEEDY (*Lancet*, January 8, 1887) a valuable distinction is made as to the location of constitutional diseases of the eye. The structures of the eye as developed from the *epiblast*, are the retina and the optic nerve, lens, epidermis, corneal epithelium; those from the *mesoblast* are the fibro-vascular tissues, cornea, sclerotic, iris, choroid, vitreous, capsule of lens, and muscles. Now it is held that the ocular affections due to the strumous diathesis, localize themselves particularly in the epiblastic structures, *e. g.*, the phlyctenular of the epithelium or anterior layers of the cornea, or of the circumcorneal zone of the conjunctiva. The same general class of structures is shown by inflammations dependent upon neuropathic causes, as diseases of the fifth nerve, or herpes; the corneal implication is superficial. But in hereditary syphilis the mesoblastic structures are selected, and in particular the deeper layers of the cornea, the iris, etc. Since, now, drugs seem to have also a selective affinity for special tissue elements, the suggestion follows that with the advance of therapeutic science, this distinction above bespoken will serve as a key to a rational progress in the treatment of ocular diseases.

NEURO-RETINITIS AND CHRONIC BRIGHT'S DISEASE.

In the *Transactions of the Am. Oph. Soc.*, 1886, DR. CHARLES STEDMAN BULL gives a careful and thorough analysis of 103 cases of Bright's disease, with the retinal manifestations, extending over a space of thirteen and a half years, and constituting about 20 per cent. of the total of such cases under his care during this period. The 80 per cent. not bespoken are the cases whose history subsequent to the first examinations was not recorded; all cases due to scarlet fever or pregnancy were excluded.

The vision was improved by treatment in 32 cases (31.5 per cent.), but the visual improvement (or relapse) was, as a rule, dependent on the changes of the renal disease. There were 46 retinal hemorrhages of both eyes, and in 23 patients the hemorrhages occurred in single eyes. In some cases there was papillitis, without the characteristic retinal exudation, though the exudation appeared later, not necessarily stellate, however. Diminution of the calibre of the retinal arteries was not constant. Absorption of the stellate exudation was never observed, however great the improvement of vision [the Reporter, however, has observed such absorption in some cases]. The author thinks no case of chronic interstitial nephritis is ever cured after cardiac hypertrophy and neuro-retinitis has set in. Attention is called to the unfavorable prognosis in these cases: Of the 103 patients, 86 (over 50 per cent.) died within one year after the first examination, and 18 within the second year; of the 103, only 17 survived at the time of reporting. Dr. Gruening, in the following discussion, stated that out of over 100 cases of his own, none lived over two years after the diagnosis of retinitis albuminurica had been made.

ORIGIN OF CHOROIDITIS DISSEMINATA.

In his address before the Section of Ophthalmology, at the annual meeting of the British Medical Association, in Brighton (*British Medical Journal*, Jan. 15, 1887), MR. JONATHAN HUTCHINSON finds reason to believe in the non-syphilitic origin of certain cases of disseminated choroiditis. The conclusions reached are these:

1. That concussion of the eyeball may produce choroiditis, but limited to the eye injured.
2. That binocular choroiditis disseminata may arise independently of syphilis in association with disorders of the nervous system, especially of the intellect.
3. That young men are liable to a peculiar form of hemorrhagic choroiditis, not dependent on syphilis, producing results indistinguishable from the syphilitic forms.
4. That there are yet other unclassifiable forms of disseminated choroiditis whose results resemble those of syphilis, but where no such disease can be reasonably suspected.

It was, of course, admitted by the lecturer that in nine cases out of ten the choroiditis was due to syphilis, acquired or inherited. The discussion following the lecture was, in general, in accord with the above conclusions. Every speaker seemed to take it for granted that the existence of interstitial keratitis is absolutely conclusive as to the presence of syphilis, an opinion we think also open to doubt. That disseminated choroiditis may arise without syphilis seems to us beyond question.

THE AMBLYOPIA OF SQUINT.

DR. O. F. WADSWORTH (*Boston Med. and Surg. Journal*, January 29, 1887) reviews the literature of the theory of *amblyopia ex anopsia*, and from his own cases he concludes against the proposition that the amblyopia of strabismus is caused by the ocular deviation. Three arguments have been relied on by the upholders of this theory:

1. That with no abnormality of the fundus or field, there is defective vision of the macula;
2. That a visual defect of like character is rarely found without squint; and,
3. That the amblyopic squinting eye improves in vision after tenotomy, disproving the congenital origin of the amblyopia.

Concerning the first point, Dr. Wadsworth finds that the vision of 57 cases of convergent strabismus, taken from his note-books, show an acuity of at least from $\frac{14}{\text{XX}}$ to $\frac{14}{\text{XXX}}$ in the squinting eye, a result considered not below what commonly happens in non-squinting eyes. As to the second point, 15 cases of amblyopia are adduced existing in non-squinting eyes, and without abnormality of appearance. Referring to the third argument, a faulty previous examination is believed to explain the supposed improvement after tenotomy: "When vision has been exhaustively tested before tenotomy, no real improvement is found after it." There is one important fact that might have been adduced by Dr. Wadsworth in disproof of the commonly accepted theory that amblyopia follows disuse, and that is the very common one that no amblyopia results from even long-continued disuse in cataract. The reviewer removed the lenses in a case of congenital cataract of sixty years' standing, with an immediate resultant perfection of vision as to acuity, colors, and refraction, where before was only perception of difference between day and night. It is true that there is this possibility of difference between cataract and strabismus, if the matter be looked at from the standpoint of the accepted theory of *amblyopia ex anopsia*, and that is, that in cataract the mind seeks to preserve the possibility of vision, whilst in the other case it seeks to neglect and quench the function. The latter idea would appear to some too volatile, while to others it would seem a support capable of bearing much weight.

A CONTRIBUTION TO THE DOCTRINE OF RETINAL GLIOMA.

FREITEL gives a very minute description (*Archiv f. Ophthal.*, xxxii. 1), clinical and microscopic, of a case of retinal glioma, from which it appears at least to be improbable that the glioma cells spread in this particular case from the primary tumor by way of the perivascular lymph-sheaths to the small disseminated metastatic patches in the nerve-fibre layer. Freitel thinks that the spontaneous power of locomotion of the tumor cells plays a very unimportant part in the heteroplastic dissemination of neoplasms in the interior of the eye. On the other hand, he thinks that the mode of origin of the metastases in the vitreous which are so often met with, may be more readily explained by assuming that the glioma was developed in intrauterine life, when the vitreous was still vascular, and that the fœtal vessels of the vitreous form the paths by which the glioma cells entered the vitreous. In the case presented by Freitel, the growth was probably at birth smaller in the right eye than in the left eye, and grew very slowly.

OTOLOGY.

UNDER THE CHARGE OF

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DEFECTIVE HEARING IN RAILROAD OPERATIVES, IN RELATION TO THE SAFETY OF THE TRAVELLING PUBLIC.

DR. LICHTENBERG, of Budapesth (*Congress of Naturalists*, Berlin, 1886), has endeavored to show the importance of good hearing in railroad operatives, and also to demonstrate that locomotive engineers and firemen are liable to various ear-diseases in consequence of their exposing employment. He speaks of the paucity, and unimportance of optical, in comparison to acoustic signals (in Germany?). The writer examined 250 railway operatives and found 92—*i. e.*, 36.8 per cent.—affected with aural diseases. 32 cases were catarrhal in form, 3 were of labyrinthine disease, and in 36 instances the disease had located in the external auditory canal. He then alluded to the statistics of railway accidents and claimed that, in view of the importance of the acoustic signals and the frequency of their occurrence, and also in view of the frequency of aural diseases in the operatives, railway accidents occur very probably as a consequence of defective hearing in the railway employés.

EPILEPTIFORM SYMPTOMS FROM DISEASE OF THE EAR.

DR. TRAUTMANN, of Berlin (*Congress of Naturalists*, Berlin, 1886), has related a case of exudative inflammation in the middle ear, in a girl, three years old, in whom there also ensued, as a consequence, epileptiform manifestations followed by peculiar paroxysms of another kind. The latter consisted in the falling of her head on her breast, unconsciousness for about one minute, then a deep inspiration and again consciousness. Several months later, Dr. Trautmann discovered unsteadiness of gait and uncertainty of speech, but no other motor or sensory disturbances. Both membranæ were retracted and in the left tympanic cavity there was a copious exudation. Paracentesis was performed and was followed by irrigation through the catheter. Shortly after the operation one of the above named attacks occurred, but after that they ceased to appear. It is held that the exudation was the cause of the epileptiform symptoms in this case. The writer expresses the opinion that in such cases of exudation in the middle ear, which occur with violent symptoms, and in which death may ensue in consequence of meningitis, infectious elements underlie the disease. He further claims that such cases occur often simultaneously in several members of a family, and at a time when naso-pharyngeal catarrh is prevalent. The treatment in such cases consists in a prompt paracentesis of the membrana tympani and evacuation of the exudation from the drum-cavity.

THE ACTION OF PILOCARPINE UPON THE MUCOUS MEMBRANE OF THE TYMPANIC CAVITY.

W. KOSEGARTEN, of Kiel (*Archiv f. Ohrenh.*, Bd. 24, 1886), has found, contrary to the experience of Politzer, that treatment by pilocarpine is useful in cases of chronic dry catarrh of the middle ear, complicated by affections of the labyrinth. Good results cannot be accomplished by a few injections, but rather, if success in these chronic processes is to be obtained, a continued repetition of the injections must be maintained for at least six weeks. The best results have been obtained when the treatment has been carried out for three months. The rule has been to make a daily injection of, on the average, one centigramme of pilocarpine. In those cases in which the treatment extended over three months, the injections were omitted every seventh day. In cases presenting a transparent membrana tympani, and also in one instance of large perforation of the membrana, in which there had been a chronic purulent process, there was visible an intense congestion of the mucous membrane of the drum-cavity and of the membrana after each injection of pilocarpine, and sometimes a secretion was observed to take place in the middle ear. Upon these occurrences the author based his suppositions, that there occurs gradually in this treatment a loosening of the stiff tissues, together with a moistening and softening of the adhesions, and thus the rigid conducting apparatus of the ear is made more readily vibratile again. It is claimed that even in cases of retained exudation absorption may occur, as was very evident in one case in which a previously very white and opaque membrana become normal in color and transparency during the treatment.

The Possibility of Recognizing by the form of the Skull Certain Topographical Features of Importance in the Temporal Bone.

Dr. Otto Koerner, of Frankfort-on-the-Main (*Archiv f. Ohrenh.*, 1886, Bd. 24, S. 67 and 68), maintains, by reason of his examinations of sixty skulls, that it is possible to locate, from observation of the external configuration of the skull, certain important points in its internal structure, especially the position of the middle fossa of the skull and sigmoid sulcus. The "index of the skull" is expressed by a quotient obtained by dividing the distance between the bridge of the nose and the most prominent point of the occiput by the distance between the parietal protuberances. This index varies from 1.55 centimetres in dolichocephalic crania to 1.07 centimetres in the brachycephalic. From tables presented, it appears that the floor of the middle fossa of the skull in the dolichocephalic lies higher above the external porus acusticus and the spina supra meatum than in the brachy-cephalic skulls.

Respecting the transverse sinus, it is shown that it, on the average, extends further outward and forward into the mastoid process in the brachy-cephalic than in the dolichocephalic skull. Independently of the form of the skull, this sinus lies further outward, on the average, on the right than on the left side. The sinus wall was of equal thickness on each side in ten per cent. of the cases, and thinner on the right side in seventy-seven per cent., and thinner on the left side in thirteen per cent.

The practical application of these facts, so far as concerns the operation for opening the mastoid, requires that the smaller the "cranial index" is, the further forward the opening should be made in the mastoid. In adult skulls, with a cranial index of 1.3 centimetres and under, it will be necessary, when possible, to operate in front of the line of attachment of the auricle, especially when the right antrum must be reached. In infants and little children, as is well known, a dangerous position of the transverse sinus does not occur.

The Question of Trephining the Mastoid Process.

After an elaborate paper on the "Diagnosis and Treatment of Acute and Chronic Purulent Inflammation of the Middle Ear-tract, and their Complications," based on 2366 cases selected from over 20,000 cases seen in private and hospital practice, Dr. Samuel Sexton, of New York, considers as follows the question of trephining the mastoid (*Transactions of the American Otological Society*, July 20, 1886).

For purposes of drainage of the middle-ear tract, he favors keeping open the outlet through the tympanum into the canal rather than through the cortex of the mastoid. He further holds that there can be no necessity for this latter operation, so long as relief is obtained by evacuation of purulent matter from the mastoid region through the more natural channel of the tympanum.

"The lower mastoid cellules, when the seat of purulent inflammation, discharge into the antrum when the passage is unobstructed, otherwise through the posterior wall of the external auditory canal, or the cortex of the mastoid process." From his observation, Dr. Sexton believes that perforative caries takes place in the former quite as often as in the latter situation. "In external periostitis the posterior wall of the canal is perhaps more frequently affected than the cortex of the mastoid process." Were there any indications to guide the surgeon in the detection of pent-up secretions in the cellules of the mastoid before a sinus had announced the fact, Dr. Sexton says he would not hesitate to perforate healthy tissues in order to relieve the patient; but he is unaware of such indications. Where an inflammatory process has caused destruction of the cortex of the mastoid, the sinus should be kept open, and even enlarged, by cutting or chiselling if necessary, remembering in such manipulations that the cranial fossa is only separated from the cellular structure by a more or less thin shell of bone. Special efforts to retain such an opening need not be made after drainage is established through the natural channel—the external auditory canal. Dr. Sexton has never been convinced that "any advantage accrues from any trephining operations which open up only the healthy cellular structure of the mastoid process, nor of the advantages, claimed by some writers, to have taken place on thus carrying a canal from the cortex into the dense hypertrophied mass produced by previous inflammation of the cellules."

Schwartze's indications for trephining the mastoid are considered in order, and rejected by Dr. Sexton as untenable.

"Of the first indication it cannot be admitted that 'œdema, pain, and fever' are pathognomonic of 'acute inflammation of the mastoid cells with retention of pus,' nor can the surgeon rely upon an incision over the mastoid, or in applications alone to relieve inflammation of the cellules, even though the above symptoms were accepted as pathognomonic of this condition."

"As regards the second indication, 'intermittent swelling,' it is of frequent occurrence where drainage from the tympanum is interrupted by the closure of a sinus from the cellules of the mastoid, or by clogging up of a tract of a dissecting tympano-mastoid abscess. It does not 'threaten life.' "

The third indication refers to matter seeking to escape from the cellules into the external auditory canal. Instead of liberating this where it presents, Schwartze proposes to establish an opening through the mastoid process. Here it is urged by him to operate "without hesitation" if "brain-symptoms" are noticed. In other words, if the symptoms are severe, open the mastoid cells for the liberation of purulent matter which is presenting on the superior wall of the external auditory canal." One of Dr. Sexton's cases, Case V., in the article under consideration, presented nearly all the so-called vital indications of Schwartze for opening the mastoid. "All of these symptoms, however, yielded upon the establishment of drainage through a free opening into the posterior superior wall of the canal where pointing was most prominent."

Schwartze's vital indication is based on "symptoms of brain-irritation" in chronic suppuration. "This is tantamount," in Dr. Sexton's opinion, "to recommending the trephining operation on the mastoid process for threatened pachymeningitis." Where periostitis interna is suspected of having reached the cellules, it has been Dr. Sexton's experience that drainage of the middle-ear tract can be best maintained through the natural channel of the tympanum, and adherence to this plan of treatment has never been attended with fatal results in his hands. "Trephining into the mastoid for threatened pachymeningitis in this manner could only be regarded as warrantable surgery at an early stage, when unfortunately no sure pathognomonic symptoms are recognizable." The expressions "threaten life," "brain symptoms," "symptoms of cerebral irritation," and the like, are regarded as too frequently used in this connection, as untenable assumptions, and misleading, and, when accepted too confidently, as "tending to increase the importance of misconceived indications, rather than the establishment of sound surgical principles."

RECENTLY DESCRIBED ANATOMY OF THE EAR.

PROF. GRUBER, of Vienna (*Congress of Naturalists*, Berlin, September, 1886), has made some discoveries in the anatomy of the region of the round window. He shows that the prevailing view that the labyrinth has but two communications with the tympanic cavity, viz., by means of the round and the oval windows, is not correct. He then demonstrates that the vestibule and the upper passage in the cochlea have a further means of communication with the floor of the tympanic cavity, by means of a chink, which can be found in the niche of the round window. In fresh preparations this chink is filled by the beginning of the ductus cochlearis, which is covered below by the membrane lining the niche of the round window. A fine bristle can, in a normal specimen, be passed with ease from the niche of the round window into the vestibule, where it can be plainly seen after the removal of the stirrup bone from the oval window. The importance of this fact in its physiological, pathological, and therapeutic bearing, is dwelt upon, and it is claimed that, in a clinical sense, the niche of the round window should receive the greatest consideration.

PRIMARY DISEASE OF THE COCHLEA ENDING IN NECROSIS.

DR. TRAUTMANN, of Berlin (*Congress of Naturalists*, Berlin, September, 1886), has described a case of the above nature, the only analogue of which he has found described in Schwartze's book.[1] The patient, a man forty-five years old, was attacked, apparently, by violent meningitic symptoms. In six weeks a perforation of the membrana tympani occurred, granulations formed in the auditory canal, and, finally, the necrotic cochlea was thrown out. The malady ended in recovery, excepting that the face remained paralyzed, and the deafness was absolute.

AFFECTIONS OF THE LABYRINTH FROM CEREBRO-SPINAL MENINGITIS.

DR. STEINBRÜGGE, of Giessen (*Congress of Naturalists*, Berlin, September, 1886), gave an account of two cases of deafness due to cerebro-spinal meningitis, occurring in his own practice. One of these occurred suddenly; the other, more insidiously. The intra-labyrinthine structures are destroyed in this disease in a peculiar way, according to this observer. He claims that in this destructive process there may be distinguished two stages, viz., first the purulent inflammation, and then the necrotic process. The latter is the direct result of the action of the blood-poison upon the small vessels in the periosteum of the semicircular canals. The occurrence of stasis and thrombosis in these vessels is the cause of destruction of the periosteum and the membranous labyrinth-structures fastened to it. The necrosis, however, is not the result of the purulent inflammatory process, but is a primary process, and thus are explained the early occurrence and irremediable persistence of deafness in many cases of cerebro-spinal meningitis.

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[1] Lehrbuch der Chirurgischen Krankheiten des Ohres, p. 376.

Destruction of tissues by pus is chiefly accomplished mechanically, as soon as the latter has accumulated in considerable quantity. For example, it is shown that small masses of pus in the neighborhood of the facial nerve, and among its fibres, can occur without producing symptoms of paralysis; while larger quantities of pus, by pushing apart the fibres of the acoustic nerve seem to destroy it, as shown by one of Steinbrügge's cases. The new formations of connective tissue must be regarded as a more advanced stage of labyrinth disease.

Attention is called to the peculiar state of the temperature in cases of sporadic cerebro-spinal meningitis. Notwithstanding the purulent inflammation of the meninges, and the considerable labyrinthine destructions, the temperature may be only temporarily elevated, and then, for long intervals, entirely normal, when either recovery may take place, or a relapse with fatal issue may ensue.

In the discussion which followed, Dr. Barth, of Berlin, called attention to the fact that in meningitis consequent upon purulent otitis, the temperature may be normal or "subnormal," for one or two weeks before death, then suddenly, perhaps, at the moment of death, it rises. Therefore, if with this low temperature, the other symptoms do not improve, the prognosis must be very guarded, perhaps unfavorable. The question whether this phenomenon is due to irritation of a temperature centre, or to other causes, remains yet an open one. Schwarze, of Halle, stated that meningitis from otitis rarely proves fatal, without a temperature in excess of 38° C. (100.1° F.)—*Archiv f. Ohrenh.*, Bd. 24, S. 73, 1886.

Pathology of Otitis Interna.

Habermann, having made a post-mortem examination of the right temporal bone of a boy who died of cerebro-spinal meningitis, gives the following result of his investigation (*Zeitschrift f. Heilkunde*, Bd. 7, Prag, 1886, and *Archiv f. Ohrenheilk.*, Bd. 24, Nov. 1886). The membrana tympani was gray, dull, and flattened. The jugular fossa was deep, containing a blood-clot, to which there was attached a pale brown thrombus, 2.5 cm. long, which had originated in the inferior petrosal sinus. In the orifice of the aquæductus cochleæ, there was seen a plug of thick yellow pus, which extended further into the aqueduct. The acoustic nerve was pale, and the greater petrosal nerve was highly anæmic. The mucous membrane over the ossicles was somewhat thickened and pale. The floor of the tympanic cavity was very thin. The microscopic examination showed that the acoustic nerve in the inner auditory canal was surrounded by pus, and infiltrated with inflammatory products. Granulation tissue was discovered in the coarser trabeculæ of the endoneurium, and a similar, though less intense condition, was found in connection with the facial nerve. The fibres of the dura mater in the inner auditory canal were found infiltrated by inflammatory products, and the bone from this point was extensively softened, containing sinuses, between which were osteoblasts. The thin plate of bone which separates the vestibule from the internal auditory meatus was wanting, its place being occupied by infiltrated periosteum. The entire cavity of the cochlea was filled with granulation tissue, which at some points had assumed the appearance and character of connective tissue, excepting the modiolus with the canalis ganglionaris, a part of the partition between the upper and middle passage, and some traces of the lamina spiralis, which were still present, but all the rest of the cochlear contents had been destroyed by suppuration. The aquæductus cochleæ toward the cranial cavity was filled with pus; toward the vestibular canal it was occupied by granulation tissue. The vestibule and the semicircular canals were affected like the cochlea, the circular ligament about the oval window was partly destroyed by granulation tissue, and the membrane of the round window was thickened. The changes in the middle ear were only slight.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF

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The Journal of Laryngology and Rhinology.

English-reading physicians will heartily welcome a journal which, under the direction of Dr. Morell Mackenzie, aims to give, in their vernacular, succinct but sufficiently full abstracts of whatever is worth knowing in current laryngological literature. Dr. R. Norris Wolfenden is associated in the editorial management, and the list of collaborators includes a number of well-known names, America being ably represented by Dr. J. N. Mackenzie, of Baltimore. The first number is a good one, and the journal will have the cordial wishes of the profession for its success.

The Laryngitis of Typhoid Fever.

Dr. Paul Koch, of Luxembourg (*Contribution a l'etude du laryngo-typhus*), sums up the result of his studies and personal observation as follows:

1. There is a true laryngo-typhus. It always coincides with the acute period of the general malady.

2. If the symptoms of laryngeal stenosis become manifest during the period of reconvalescence from typhoid fever, they are the expression of the perichondritis which in general is manifested in acute maladies of long duration.

3. Operation is indicated as soon as the symptoms of laryngeal stenosis become disquieting.

4. Tracheotomy should always be performed low down, so as to avoid the cricoid region.

5. It requires patience to abandon these perilaryngites and perichondrites to their natural course, which is very long, without wishing to hasten definitive recovery.

6. If, after definitive recovery, the patient cannot dispense with the canula, there is plenty of time to employ mechanical treatment by the two routes open; and, should this not succeed, to practise a resection of a portion of the larynx.

The same author reports a case of laryngeal stricture consecutive to typhoid fever, cured nine years later by tracheotomy and incandescent destruction of an interfering fold of laryngeal mucous membrane.

Submucous Injection of Lactic Acid in Laryngeal Tuberculosis.

Dr. George W. Major, of Montreal (*Canada Medical and Surgical Journal*, Dec. 1886), reports his favorable experience with this method of treatment, originated by Hering, of Warsaw, and subsequently adopted by Krause, of Berlin, who first introduced the superficial application of lactic acid into the therapeutics of tuberculosis of the larynx. The instrument employed is on the principle of the hypodermatic syringe, the needle being of proper length and curve to permit of ready manipulation. The strength of the solution employed varies from twenty to eighty per cent., the quantity injected being from five to ten minims. Should a slough form at the point of puncture, active treatment is to be suspended, but recourse may be had meanwhile to spray of a weaker solution. On separating, the slough leaves a healthy granulating surface, which completely heals in a few days. The method is especially efficacious in the early stages of the disease, that of submucous infiltration, characterized by the pyriform tumefaction of the aryteno-epiglottidean folds.

Ecchondroses and Exostoses of the Larynx.

M. Henry Bertoye (Lyons), in a reprint from the *Annales des mal. de l'oreille et du lar.*, collates recorded cases and adds a personal observation. His patient was a man, forty-two years of age, who died of pulmonary complications seven days after tracheotomy. The tumor, which occupied nearly the entire right side of the internal face of the cricoid cartilage, was hemispherical in shape, and histologically resembled hyaline cartilage undergoing ossific change.

Peroxide of Hydrogen in Whooping-cough.

Dr. B. W. Richardson (*Asclepiad*, No. 13) has treated nine cases of whooping-cough, six males and three females, with peroxide of hydrogen exclusively; giving a fluiddrachm of the ten volume solution five or six times daily. He has not seen equally good results from any other treatment, except change of air. He uses the following formula:

"Hydrogen peroxide (10 vols. strength) . . . ʒvj.
Glycerine, pure . . . . ʒiv.
Water, distilled . . . . to ℥iij.—Mix.

To make a solution of three fluidounces, of which let half a fluidounce be taken in a wine-glass of water, as directed."

When there is stridulous spasm, he substitutes ozonic ether, ʒij, for the solution of the peroxide, or adds it to the mixture.

Epileptiform Seizures from Post-nasal Polypus.

To the few instances on record of convulsions apparently epileptic, due to reflex irritation from nasal polypi, is to be added a case reported by **Dr. B. W. Richardson**, in the *Asclepiad*, No. 13, 1887. A married lady, aged thirty-four, not at all hysterical, who had been unsuccessfully treated for epilepsy, stated that the cause of the attacks seemed to be in the back of the throat, and to be produced by something that dropped into the larynx, as when one "swallows the wrong way." Nothing abnormal was found in the larynx, but while the mirror was in the throat a large drop of fluid fell from the post-nasal cavity. Examination being thus directed to the nose, a polyp was discovered, and removed entire with forceps. It was a large fluid gelatinous mass, the size of a large walnut. When gently pressed, drops of gelatinous fluid exuded. For eight years there has been no recurrence of the growth, or of the epileptiform seizures.

LOCAL TREATMENT OF ACUTE SUPPURATION IN THE MAXILLARY SINUS.

PROF. STOERK, of Vienna (*Wien. med. Woch.*, No. 43, 1886), recommends the use of a syringe, with a delicate tubular nozzle, to be introduced into the nasal outlet of the sinus, so that the sinus can be thoroughly syringed; a method which he has found preferable to all others. When the tumefaction of the nasal mucous membrane is too great for this procedure, Stoerk merely attempts to reach the vicinity of the opening with the extremity of the syringe, trusting to the sensations of the patient to indicate the moment in which the stream of liquid enters the sinus, and then makes marks on the instrument to facilitate subsequent manipulations. Medicaments should be applied warm, as a rule, and in weak solution; for example, no stronger than a one or two per cent. solution of silver nitrate.

STRICTURE OF THE ŒSOPHAGUS.

Successful graduated dilatation of a stricture, from deglutition of concentrated lye, in a child two years of age, is reported by **DR. WALKER SCHELL**, in the *Indiana Medical Journal.*

DR. MCPHEDRAN, of Toronto (*Med. News*, Feb. 12, 1887, p. 191), performed gastrostomy in a woman, aged forty-one, for malignant stricture of the œsophagus, the patient surviving six months and eighteen days.

GASTROTOMY AND DIGITAL EXTRACTION OF A FOREIGN BODY FROM THE ŒSOPHAGUS.

DR. MAURICE H. RICHARDSON (*Boston Med. and Surg. Journ.*, Dec. 16, 1886), on August 5, 1886, performed gastrotomy, and, inserting his hand and forearm through the wound, succeeded in withdrawing a plate of false teeth from its lodgement in the œsophagus. Under antiseptic treatment, recovery was complete on the 25th of October, the patient returning to his work as a teamster.

INFLUENCE OF ETHER UPON THE MUSCLES OF THE LARYNX.

DRS. SEMON and **HORSLEY** (*Brit. Med. Journ.*, August and September, 1886) have made an important investigation upon the differential action of ether and of electric currents of various strength upon the abductor and adductor muscles; following the researches of HOOPER and of DONALDSON, Jr. As the whole subject is reviewed in PROF. BOWDITCH'S paper in the present number of this journal, no more than the simple record is needed in this place.

DERMATOLOGY.

UNDER THE CHARGE OF
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Lanolin.

Liebreich (*Deutsche medicinische Wochenschrift*, No. 28, 1886) directs attention to several important points regarding lanolin. Its keeping qualities, as well as its non-irritating properties, depend upon the thorough elimination of its free fatty acids. In the crude wool-fat these acids are present in the proportion of twenty to thirty per cent. Analyses of the different preparations of lanolin (wool-fat plus a proportion of water) on the market disclose wide differences in this respect; that by one pharmacist being practically free from the fatty acids, while in that of another, doubtless on account of partial elimination of the neutral wool-fat, these acids are found present in greater proportion than occurs in the crude wool-fat; in the others the percentage varies between these two extremes. The following are the actual results: Heiner's, 23.24 per cent.; Merck's, 12.23 per cent.; Riedel's, 11.12 per cent.; Jaffé & Darmstädter's, 0.05–0.5 per cent. In the lately introduced lanolinum anhydricum the following percentage: Heiner's, 33 per cent.; Metcalf & Co.'s (agnine), 26.8 per cent.; Merck's, 17.5 per cent.; Eisner & Mendelsohn's, 16.98 per cent.; Riedel's, 16.65 per cent.; Jaffé & Darmstädter's, 0.5–1 per cent.

In ointments containing considerable powder, and also in those containing chemicals which are apt to undergo change when in intimate contact with water, lanolinum anhydricum is to be preferred as the base; also in those ointments, in the preparation of which heat is required. In other instances the ordinary lanolin may be employed. In general, it may be stated that ointments made with the ordinary lanolin are stiffer than those made with lanolinum anhydricum.

Schweninger (*Charité-Annalen*, xi., Jahrg., 1886) gives his experience with lanolin, having treated about two hundred cases of skin disease at the dermatological clinic of the Charité Hospital in Berlin with this remedy. Where practicable, and where the disease was symmetrical, one side of the body was treated with lanolin ointment and the other side with various fats, glycerine, and vaseline ointments. In all cases, without exception, the results were in favor of lanolin. It is to be especially recommended for the relief of thickened, scaly conditions, roughness of the epidermis, eczema, psoriasis, pityriasis, prurigo, and ichthyosis. Moreover, the lanolin preparations are useful where a penetrating action (as in syphilis) is desirable, and where thickened epidermic layers are to be relieved.

LICHEN RUBER.

CÆSAR BŒCK discusses lichen ruber in Norway (*Monatshefte für prak. Dermatologie*, October, 1886), more especially in Christiania, where, as in Northern Germany, the disease is of infrequent occurrence, the author having encountered only seven cases during a period of eleven years. Both varieties of the disease—the acuminate and the plane—were met with, but more frequently the plane. In two cases the acuminate was combined with the plane, but the former was in no instance found to exist alone. The subjects were all in good circumstances, an observation which has been on more than one occasion noted concerning the etiology of this affection by other reporters of cases. Bœck considers that the so-called lichen ruber (Hebra) and lichen planus (Wilson), constituting respectively the acuminate and plane varieties of the lichen ruber of most authors, are one and the same disease, a view which is in opposition to the opinion of Robinson, of New York, who regards a slightly developed horny layer of the epidermis as characteristic of lichen planus. Bœck finds that this layer, although often variable in its development, is, as a rule, strongly marked, which, he adds, is in accord with clinical observation. All the cases reported were of a mild type, though two had existed thirteen and twenty-six years. The author observes that the disease pursues a variable course in different countries, concerning which point there seems to be no doubt.

RARE FORMS OF IODIDE ERUPTION.

JANOWSKY (*Monatshefte für prak. Dermatologie*, October, 1886) gives three cases of rare forms of iodide eruption. The first is that of a man, the subject of syphilis, aged fifty, and is similar to one reported by Morrow, of New York. The face was involved, and the affection was characterized by febrile symptoms, swelling, and an eruption of distended, clear vesicles of variable size. The mucous membrane of the mouth was also invaded. In the course of a few days the eruption became crusted and eczematous in appearance. Iodide of potassium was found in the urine and also in the vesicles. The efflorescence appeared on the second day, after only thirty grains had been taken, and was the second time the patient had suffered from the cutaneous manifestation. The second case was that of a syphilitic woman, the lesions being hemorrhagic, of the form of purpura, and involved the lower extremities. Similar cases are reported by Fox and by Thin. The third case occurred in a syphilitic man, forty-six years of age, the cutaneous lesions resembling erythema nodosum, but lacking the bluish tints. The urine contained iodine. The disease was produced a second time by again using the iodide after the first attack had passed off. The author regards this case as being like those described by Pellizzari a few years ago, and inclines to this observer's view of the specific action of iodine on the vascular system. It has been repeatedly shown that the extent of the eruption bears no relation to the amount of the medicine used.

ICHTHYOL.

In the *Chicago Medical Journal* for December, 1886, ZEISLER reports his experience with ichthyol. Externally, in all forms of eczema it proved useful, the result in all but a few cases being favorable; according to the degree of acuteness, the remedy should be applied in the proportion varying from five to thirty per cent. In sycosis its effects were good in a majority of the cases; it was employed in the form of a ten per cent. ointment, in conjunction with a soap of ichthyol. In acne vulgaris the results were not positive. In acne rosacea its favorable influence was undoubted.

Internally, the remedy was given in about twenty-five cases, in doses varying from three to to fifteen grains thrice daily. In general, as the author states from his limited experience, it may be said that in all cases in which the rheumatic diathesis and dyspeptic ailments may be considered etiological factors ichthyol will have indirectly a favorable influence by removing these conditions. Independently of such predisposing causes, however, it acted well, in the author's experience, in a few cases of acne and acne rosacea in which it was prescribed. Possibly in some instances it may act, as suggested by Unna, by its contracting effects upon the cutaneous capillaries.

PROF. SCHWENINGER (*Charité-Annalen*, xi., Jahrg. 1886) has, since 1883, employed ichthyol, chiefly in from ten to fifty per cent. solutions, in rheumatism, lumbago, neuralgias, gout, and migraine, and finds that in relieving the pains accompanying these diseases it acts better than any other known medicament. It also proved useful in the treatment of open wounds and in gangrenous sores, applied on cloths or lint, and relieved pain about as effectually as the other well-known remedies. In chronic eczema a ten per cent. ointment with oxide of zinc was employed, and in keratoses, where the epidermis had been previously removed by maceration and soap, it was found to cause healing rapidly. Internally, in the form of capsules, containing ten per cent. solutions in ether, alcohol, glycerine, or water, it also proved valuable in various skin diseases, malaria, and East Indian fever.

IMPORTANCE OF THE USE OF THE ABSOLUTE GALVANOMETER IN THE DESTRUCTION OF SUPERFLUOUS HAIR BY ELECTROLYSIS.

In a recent number (November 4, 1886) of the *Boston Medical and Surgical Journal*, PRINCE contributes some practical points to the subject of the removal of hair by electrolysis. The great desideratum is to effect the destruction of the papillæ without the production of scarring. In a certain percentage of cases this untoward result has been recognized by all observers as practically inevitable, and has been considered due to individual peculiarity of the skin. Prince is of the opinion, however, that such a result is more probably caused by the use of too strong a current. The great variability in the strength of the current from the same number of cells, not only in different batteries but under varying conditions in the same battery, is well known, and hence the customary statement to use a certain number of cells is unscientific, and not without its dangers as relates to the matter of scarring. Another gauge usually advised is the occurrence of effervescence about the outlet of the follicles; but this is equally unscientific as this does not always show itself, and moreover the destruction of the papillæ may be effected with less chemical action than implied by effervescence.

All precautions should be taken toward avoiding variability in the current;

for instance, instead of the sponge electrode, with which the current is weaker or stronger according to the degree of compression made, the positive electrode should consist of a metallic plate, covered either with chamois or a layer of absorbent cotton and fastened to the forearm. This being the case, there should, of course, be an arrangement by which the current at the positive side could be broken before the needle is withdrawn. A suitable galvanometer, such as the author describes, permits thorough control of the battery, and the strength of the current may be readily measured. A current of one milliampère, passing two or three seconds, the author finds most satisfactory; it never should exceed two milliampères. If the papilla is not destroyed in the time stated, the fault lies with the introduction of the needle—the failure to strike the papilla. During the sitting constant attention should be given to the galvanometer, in order that the current may be kept at a uniform strength.

The Treatment of Hypertrichosis.

Karewski, in a paper (*Deutsche medicinische Wochenschrift*, No. 34, 1886) on this subject, discusses the now well-known method by electrolysis and a new method by the galvano-cautery. The author's experience with electrolysis has been such as to confirm its practicability and efficacy. An interesting point is his statement that there is practically no difference in the results, whether the needle is attached to the negative or to the positive pole, as at both poles disintegration will take place. If, however, the needle is attached to the positive electrode, it is necessary that it should be one of platinum or platino-iridium; with a steel needle oxidization occurs, the oxide of iron is left in the follicle, and a permanent pigment-speck remains. In regard to the method by galvano-cautery, the author speaks equally favorably. A suitable handle is required, to which is attached a properly constructed needle. This latter consists of two platinum wires which are welded together at one end and ground to form a needle as fine in calibre as that commonly employed in electrolysis. The two free ends are attached to the handle, one connecting with the positive electrode and the other with the negative. When the battery is put in action the needle becomes heated to a white heat, and is then ready for the operation. (In the original paper a descriptive cut is given of both the needle and handle.—Eds.) The procedure is, in its further steps, somewhat similar to that of electrolysis.

The author sums up his experience with both methods as follows: 1. Both the galvano-cautery and electrolysis are adapted for the permanent removal of superfluous hair. 2. Both accomplish the purpose, with few exceptions, without perceptible scarring. 3. The galvano-cautery is more rapid and less painful, but the operation is, for the days immediately following it, more disfiguring.

The Anatomy of Keloid in its Early Stage.

An opportunity was offered Crocker (*British Medical Journal*, September 18, 1886) of studying the anatomy of a keloidal formation, arising from a scar, of less than a month's growth. Histologically the tumor was found, even at this early stage, to differ but slightly from similar growths at a more advanced period, except that there still remained an abundance of cells and nuclei, and as yet very few, if any, of the bloodvessels had been obliterated and changed into fibrous bands, as is known to happen as the tumor develops, especially in the central portions. The author considers the division of keloid into two classes—true and false—to be without anatomical or clinical foundation. An interesting and practical point evolved, confirmatory of Warren's observations, is that the bloodvessels are affected far beyond the tumor. The value of this observation is obvious, as in those cases in which interference is deemed advisable, it is essential, if a recurrence is to be avoided, to cut wide of the growth in order to get beyond the diseased vessels. The tumor, the investigation of which formed the basis of this paper, was treated in this manner, and four months later there had been no sign of a return.

A Contribution to the Clinical Study of Scleroderma.

The notes of two cases of this disease are given (*Journal of Cutaneous and Venereal Diseases*, November, 1886) by **Graham**. In one, a woman, aged forty-seven, the affection, which involved the whole surface, ran its course in ten months, ending in complete recovery. There was at no time œdema, and there was but slight pigmentation, and this limited to the back of the neck and the upper lip. In the second case, a male, aged thirty-nine, the disease involved the trunk and limbs with considerable pigmentation and, in the beginning, œdema. Up to the time of report it had shown no marked change for the better. In both of these cases there was a family history of rheumatism, although in neither had the patient suffered from the ordinary phenomena of this disease. From a study, symptomatically and pathologically, of the disease, based upon cases afforded by the literature and his own experience, the author is led to look upon it as a manifestation of the rheumatic diathesis, and, in view of this conclusion, advises the employment of anti-rheumatic remedies, such as potassium iodide, salicylate of sodium, etc., and, externally, baths, friction with oil, and the like. The author shares the view of several other observers in stating that there are two forms of the disease—acute and chronic; his first case representing the acute type and the second case the chronic form. In regard to the relationship of scleroderma to morphœa, Graham inclines to the belief that they are closely allied, but for the present it is inadvisable to class them as one disease.

A Case of Exfoliative Dermatitis (Pityriasis Rubra?) with Bullous Lesions.

In the *Journal of Cutaneous and Venereal Diseases* for November, 1886, **Hardaway** reports a case in the course of which to the ordinary symptoms of pityriasis rubra was added, for a period of a week or ten days, the presence of bullous lesions. These appeared in crops of a dozen or less, and were scattered irregularly over the general surface. Each crop was preceded by a chill, with subsequent slight elevation of the temperature; but there was no regularity in their appearance. This anomalous formation then disappeared, and subsequently, at least so long as the case was under observation, the usual symptoms of pityriasis rubra were noted.

TWO CASES OF LUPUS TREATED SUCCESSFULLY WITH IODOFORM.

TYRRELL reports (*British Medical Journal,* October 30, 1886) briefly two cases of lupus vulgarus involving the nose and upper lip, in which the local treatment consisted solely of the application of iodoform in the form of an ointment (a drachm of iodoform to the ounce of vaseline). Cod-liver oil was prescribed in both cases. The parts soon assumed a healthy appearance, healing gradually but uninterruptedly; in one case a cure resulting in six months, and in the other in four to five months.

PASTES IN CUTANEOUS THERAPEUTICS.

According to MARTIN'S experience (*Deutsche medicinische Wochenschrift,* December 30, 1886), better results follow the treatment of inflammatory skin diseases, especially those of an eczematous type, by means of pastes than are to be secured by other methods. What is commonly known as Lassar's paste—Ac. salicylici, gr. x; pulv. zinci oxidi, pulv. amyli, āā ʒij; vaselin, ʒij—was employed in the author's cases. It may be advantageously used in all forms of eczema. Where the parts affected permitted—as, for example, about the hands, arms, legs, etc.—the skin, after a thorough soap and water washing, is coated over with a thick layer of the paste, this covered with a thin film of clean cotton, and then a bandage of gauze applied. This dressing may remain on for several days, and in some instances even a week or longer. Rarely more than the repetition of three such dressings is necessary for a cure. When the eczema is upon the face, for obvious reasons the above method of application is impracticable, and the paste is, therefore, simply smeared on at frequent intervals. About the angles of the ears and nose, after applying the paste, a small thin film of cotton may be stuck on over it with better effect.

MYCOSIS FUNGOÏDES.

KÖBNER presents (*Deutsche medicinische Wochenschrift,* Nos. 39 and 40, 1886) the results of a careful study of this curious affection, based upon clinical observation and an analysis of the literature of the subject. Two cases are reported in full; in one of which the type was mild, and under increasing doses of arsenic recovery took place (two and a half years later there had been no reappearance of the disease); in the other case, the disease followed the usual course, a fatal result ensuing a few years after its first appearance.

Clinically there seem to be two varieties of the disease. In one, which the author's first case represents, the disease is usually more localized, being confined to several regions; the tumors are not so liable to sudden appearance and disappearance, are of slow growth, and there is no disturbance of the general health. There is always, however, the usual premonitory stage of red, eczema-like patches or superficial infiltration. This variety is apparently susceptible of relief by the arsenical treatment.

The second variety is more frequently observed. Its course may be divided into four stages. The first stage shows only erythematous patches or scattered eczematous lesions, and occasionally urticaria-like eruption. This may last from one to two years (and rarely as happened in the author's second case, entirely disappear), when the second stage, which may appropriately be called the period of (flat) infiltration, begins. These lesions which are flat or semi-globular, bright or vermilion-red, exceedingly itchy, soft to tolerably tough, covered with a tense and shiny epiderm, may disappear entirely in one place and a new and similar growth appear in other regions, going through the same stages. In some of these growths the centre only is absorbed and there remains a peripheral desquamating wall. After some months, by additional growth or confluence of such infiltrations, or from an eczematous basis, or less frequently from an area of skin previously involved and healed, or from apparently sound skin, appear the peculiar, knobby, polymorphous tumors, ragged or furrowed, dark red, in appearance not unlike a tomato or mushroom. In this, the third stage, the growths may in a short time, individually or through confluence, become the size of an orange or larger, and rarely a tumor may become pedunculated. Itching persists, and there is a constant serous discharge, which, with the exfoliating epiderm, gives rise to crusts. Even in this stage individual tumors may disappear by absorption without leaving a trace. At this time also superficial ulceration of the growths is noted, from which oozes a considerable amount of serum and thin pus, which rapidly undergoes decomposition, and, in spite of antiseptic applications, gives rise to a fetid odor. Only after months does the general health begin to suffer, exhaustion being gradually induced through loss of sleep in consequence of the intense itching, and from the constant serous and purulent discharge. In this way the disease gradually goes into the fourth stage—the stage of cachexia, in which, in addition to superficial ulceration, the growths may be the seat of deep-seated, crateriform ulcers; in fact, there may be a complete slough of individual tumors, the destructive process extending, in some instances, through to the periosteum. In some cases the growths may appear on the mucous membranes. Wasting diarrhœa, frequent chills, with increased temperature, which are often met with in this stage and hasten the end, may be looked upon usually as symptoms of septicæmia. The usual complications which lead to a rapidly fatal issue are, above all, pneumonia and pleuritis, with rapid effusion; less frequently nephritis and uræmia. According to published cases, an unquestionable example of metastasis to internal organs has not been observed.

Briefly stated, there was found, microscopically, infiltration of the corium, made up of large, mainly round, and to a less extent ovoid, single-nucleated cells lying between the greatly separated connective-tissue fibres; the cell infiltration, in the middle of the markedly developed growths, was so great as essentially to destroy all traces of these fibrillæ. Between the cell masses were seen scattered large cells containing several nuclei, variously shaped "Mastzellen," and, especially near the lower border of the infiltration, remarkably large spindle-shaped cells, filled with finely and coarsely granular protoplasm. In recent growths could be seen the cell accumulations beginning around the subpapillary, superficial vessels of the corium, and extending upward along the papillary branches to the corneous layer, which is finally broken through and ulceration results. In the rete were seen many wandering cells, and here, as likewise in the papillæ, branching brownish pigment cells. The bacterial investigation, carefully made, gave negative results.

The author contends, both from the anatomical data and the clinical course of the disease, and especially from the fact that the tumors may undergo spontaneous involution, that the view which classes it as a sarcoma or related disease is erroneous; and states that if the affection in its entire course be studied clinically and histologically, this becomes evident. His own view is that it is a typical chronic infective disease, and that Bazin's view of its analogy to leprosy has much evidence in its favor.

Impetigo Contagiosa.

A paper on this disease is contributed (*Daniel's Texas Medical Journal*, August, 1886) by Beall. His experience embraces twenty-four cases. Clinically the cases illustrated the disease as ordinarily described. A peculiarity, in a few of the cases, in the separation of some of the crusts from the underlying skin was noticed—detachment beginning at the centre and progressing centrifugally. When this occurred the maculation showing the site of the lesion, and which persists for some time afterward, displayed different degrees of intensity in concentric rings—the darkest at the periphery, and the lightest at the centre. This peculiarity, when present, the writer thinks may be considered pathognomonic. At the time of observation of the first group of cases, smallpox was prevalent, and hence vaccination largely practised, and in these cases there may have been some relationship between that operation and the contagious impetigo; in the group of cases recently observed, however, no relationship was demonstrable. In examination of the crust a peculiar microörganism was discovered, to which, in the author's judgment, the disease is to be attributed. The same organism was subsequently found also in the fluid of a matured vesicle. The crust was treated with a three per cent. solution of pure caustic potash, then stained with eosin, and mounted in glycerine. The examinations were made with a one-fifth Gundlach objective, D eye-piece, and amplifying tube. Differentiation was facilitated by staining. In the microscopic field could be seen epithelium, scattered oil globules, and crystals of margarine, and numerous minute, round, and oval bodies. These last, the microörganisms, were constant, and "in all probability the direct factor in the etiology of the disease." These organisms, under white light, were colorless, highly refractive, spheroidal and ovoidal, and $\frac{1}{8000}$ to $\frac{1}{5000}$ of an inch in diameter, and scattered through the field singly or in pairs.

MIDWIFERY AND GYNECOLOGY.

UNDER THE CHARGE OF

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The Desirability of the Early Performance of Laparotomy in Cases of Abdominal Pregnancy.

Lusk (*Brit. Med. Journal*, December 4, 1886) first narrates his case, which is briefly as follows:

Mrs. B., æt. thirty-five, menstruated regularly until the end of October, 1883. On Oct. 24th of the same year, and also on Nov. 6th and 7th, she had severe attacks of pain referred to the right side, but radiating over the abdomen. Pregnancy was diagnosticated, and confinement expected in July, 1884. On July 17th there was some vaginal discharge, a few pains, but no other signs of labor. Doubt was now cast on the supposition of pregnancy, one consultant alleging it was cystofibroma of the posterior uterine wall. The tumor diminished after the death of the fœtus, and was considered an abdominal pregnancy by Drs. Fordyce Barker, Thomas, and Lusk, who were now consulted. Operation was advised by them should dangerous symptoms arise, but was put off on other advice, until her strength was reduced by diarrhœa and septic mischief. In March, 1886, the condition was serious: pulse rapid, temperature 104° F., great emaciation and anæmia. Operation was performed on March 19th, as follows: After a median incision below the navel, the sac, non-adherent to the abdominal walls, was opened. Colorless water and fetid gas escaped, and then a macerated shrunken fœtus was removed, but no trace of placenta or cord could be found. The edges of the sac were stitched to the abdominal wound, free stimulation employed, but the patient sank forty hours afterward. On post-mortem it seemed as if the ovum had developed in the fimbriated end of the Fallopian tube.

Lusk adds four tables of cases as an aid to settling the point of early operation or not. In Table I. there are 29 cases of abdominal pregnancy, ending in fistulous openings; of these 9 died, and many of the remainder can hardly be dignified with the term "recovery." In Table II. 8 cases are given where death occurred before fistulæ formed. In Tables III. and IV. there are collected 52 cases of laparotomy (secondary) for abdominal pregnancy, with a mortality of 15, and recovery of 37. This does not give a fair picture of what might have been done, as in only 3 of the 15 could the operation be charged with the fatal result. In Table V. 11 cases of primary operation are recorded, with two maternal recoveries, and two children saved. Lusk is cautious in his conclusions, but recommends primary laparotomy and improvement in the technique of secondary laparotomy in the direction of earlier operation and entire removal of the sac.

The following few cases illustrate the moot question of the treatment of early tubal pregnancy:

Lawson Tait (*Brit. Gynec. Journ.*, November, 1886) showed a preparation of tubal pregnancy removed after rupture of the sac. The patient was so collapsed that operation had to be delayed for some hours until the use of stimulants and hot-water bottles brought on reaction. The left tube was then removed by laparotomy, and a large quantity of blood removed. Recovery was uninterrupted.

Hart (*Brit. Med. Journ.*, December 4, 1886) records a similar successful case.

Mundé (*Am. Journ. of Obstetrics*, January, 1887) showed at the New York Obstetrical Society a specimen of tubal pregnancy. The patient was admitted into hospital with the history of sudden violent pains, and collapse occurring the day before. The pulse was 120, respiration 24, and abdomen tympanitic. From this, and the fact that the patient had menstruated six weeks before, rupture of a Fallopian tube and pregnancy were diagnosticated. The usual palliative treatment was employed, but the patient suddenly collapsed in a few days. On post-mortem, a tubal gestation firmly adherent in Douglas's pouch, was discovered with a slight rent on its posterior surface.

The pathologist expressed his opinion that it would have been impossible to arrest the hemorrhages by laparotomy. In the discussion on this specimen, Dr. Janvrin related a case where, after recovery from partial rupture, he applied galvanism to destroy the fœtus. The morning after the third séance, nine days after the first hemorrhage, the patient was seized with tremendous bleeding, and died in forty hours. On post-mortem, a slight rupture, involving a small artery, was found, as well as a second and more complete rupture at the same point.

CASE OF EXTRA-UTERINE GESTATION ARRESTED BY ELECTRICITY.

Dr. Aveling's case (*Brit. Med. Journ.*, December 4, 1886) had the ordinary symptoms and signs of extra-uterine gestation, viz., suppression of menstruation, occasional severe colicky pains, expulsion of portions of decidua, and, finally, at the third and fourth months, a retro-uterine tumor steadily increasing in size. Dr. Aveling applied the interrupted current, the negative pole over the swelling felt through the vaginal roof, the positive over the abdominal wall. Each application lasted ten minutes, and after four such, made on consecutive days, great improvement took place, the tumor becoming decidedly smaller and pain lessening. In two months the swelling, originally the size of a man's fist, could be felt only as a small elongate body.

EXTRA-UTERINE GESTATION TREATED BY GALVANIC PUNCTURE.

Dr. Petch (*Brit. Med. Journ.*, December 4, 1886) used the galvanic current in his case passing insulated needles into the tumor. A Leclanché battery was used and the current of thirty cells allowed to pass for an hour.

In Dr. Petch's case the gestation had gone on beyond the fifth month as fœtal heart sounds were heard, and fœtal movements felt by the patient. The day after the current was used, the heart sounds were feeble and in three days could not be heard. Twelve months afterward the tumor was the size of a cocoanut, and in three years it had disappeared.

In this case the galvanic current was used "from consideration of its well-known chemical effects in the coagulation and decomposition of albuminous tissues, and its power of splitting up both organic and inorganic substances into various absorbable products."

The following facts should be remembered in connection with the use of electricity in early extrauterine gestation.

1. The placenta may grow after the fœtus is dead. 2. Manipulation of the uterus, such as passing a sound into it, may cause rupture of the sac. 3. The dead fœtus may not be absorbed. 4. Diagnosis is doubtful in some cases.

CASE OF FORCIBLE TEARING OUT OF THE UTERUS, AND COMPLETE DESTRUCTION OF THE RECTO-VAGINAL SEPTUM; RECOVERY.

Schmalfuss reports (*Centralbl. für Gynäk.*, No. 46, 1886) an interesting medico-legal case, showing the tolerance of the female pelvic organs to the most violent injury.

M. B., forty years of age, was brought by the police to the Infirmary. The history given was as follows: The patient had been drinking with two workmen, who afterward had connection with her consent. She then felt great pain in the lower part of the abdomen, and became unconscious. Fourteen hours elapsed before she was attended to medically, when the following was found to be her state:

She was stupid looking, clothes covered with mud and blood, and in some respects looked like a woman who had been confined. The pulse was feeble, easily compressible, but not specially bad; sensorium clear; no fever and no pain, except a burning in the lower part of the abdomen. On local examination, a fleshy lump was noted protruding from the introitus vaginæ; it was covered with clots and mud, and at first sight looked like an expelled placenta. When cleansed, however, it was discovered to be the uterus torn from its attachments, and brought outside the vaginal entrance, so that the os looked to the anterior vaginal wall, and the fundus to the ground. The whole recto-vaginal septum was torn through, and the uterus retained only by the remaining part of the anterior vaginal wall and the left ligaments. At the lateral angles of the uterus one could see parts of the round ligaments, the tubes, and the broad ligaments, and at the fundus and posterior wall false membranes; the ovaries were not in sight, and the bladder and urethra were uninjured. There was no bleeding. The bladder was allowed to remain full, so as to prevent any further prolapse of abdominal contents.

The treatment adopted was as follows: The uterus was severed from its remaining attachments, elastic ligatures being employed. The lacerated portions of the vagina and septum were removed, the cloaca washed out with corrosive sublimate (1:5000), and plugged with iodoform gauze. The patient recovered, and when examined on the twenty-first day had the following local condition: A deep cloca was present, whose anterior and antero-lateral walls were vaginal, the posterior and postero-lateral being rectal mucous membrane. Bridges of granulation tissue lay between. By two plastic operations the recto-vaginal septum and sphincter ani were restored.

This injury had evidently been caused by the perpetrator passing his hand into the rectum, seizing the uterus, and forcibly dragging it out, the recto-vaginal wall being necessarily torn. The full bladder, fainting of the patient, and the old uterine adhesions, helped to render the injury so far harmless.

CURE OF SEVERE PUERPERAL DISEASE BY AMPUTATION OF THE SEPTIC CORPUS UTERI.

SCHULTZE, of Jena (*Deutsche med. Woch.*, Nov. 4, 1886), records here a remarkable case where he amputated a bicornuous uterus for retention of the placenta in the pregnant horn and septic infection.

F. S., twenty-one years of age, had, in the seventh month of pregnancy, a dead child born (Sept. 7). The placenta was retained, and the midwife, in her attempts to remove it, tore away the cord. Some time afterward the medical man who was summoned found the cervix of the double uterus so narrow that he was unable to reach the placenta. Expression was of no effect. She was then taken into hospital, and on the following day the same difficulty felt. Hot baths, the constant current, and deep narcosis had no influence on the calibre of the canal, which scarcely admitted a finger.

On the 9th the evening temperature was 39.9° C., and there were rigors, with putrid discharge.

On the 10th examination under deep narcosis was again had recourse to, and a stricture admitting the finger found in the right horn. The left horn was empty. In the right the placenta was found adherent, and a small stinking piece was removed. On the 11th the temperature was 40.1° C., and there were rigors and beginning peritoneal disturbance. Laparotomy was therefore performed on the morning of the 13th (sixth day of puerperium). Schultze had before him three courses, viz., to do a conservative Cæsarean section, removing the placenta only, or if necessary to remove the horn with the placenta; most probably he considered the amputation of both horns would be required. The incision from navel to symphysis was made in the middle line, the uterus turned out with the hand, an elastic ligature applied, the uterus incised, and the stinking placenta removed. The uterine wall was found to be rotten, the putridity extending to 2 mm. below the peritoneal reflexion. As the left horn was also discolored, amputation of both horns was imperative. There was an exudation in the pelvis. The infundibulo-pelvic ligaments (of the ovary) were found so short that a pure Porro's operation could not be carried out. These ligaments, therefore, were tied and divided, the uterus and ovaries brought out, and any part of the broad ligament gaping between the elastic tube and the ligatures stitched with a running catgut suture. It was evidently impossible to treat the pedicle by Schröder's method for fibroids, as pus could be squeezed out of the lymphatics of the stump; it was therefore fastened in the abdominal incision according to Hegar's method, the peritoneum stitched to it below the elastic tube, the surface of the stump seared, and afterward chloride of zinc applied. The temperature soon fell, and on the ninth day the seared portion of the stump was removed with scissors.

Schultze finally lays down the following indications for such interference, viz., the mischief must be in the uterus, and the possibility of septic thrombosis and embolism elsewhere must be excluded. [In a case of pregnancy in the horn of a double uterus which I saw in consultation, the labor came on at the seventh month, the placenta was adherent and removed with difficulty, and only after deep narcosis, owing to marked spasm of the contraction ring. The patient made a bad recovery.]

INGLEBY LECTURES ON ABDOMINAL SURGERY.

MR. TAIT records (*Medical Press and Circular*, Nos. 20 and 21, 1886), *inter alia*, a case where he performed abdominal section for puerperal peritonitis. The patient was under Dr. Lycett's care, and had a severe operative labor. On the third day acute peritonitis appeared in the right iliac region, and soon became general. There was great distention on the fifth day, pulse 135, hiccough, and incessant vomiting. Next day, when seen by Mr. Tait, the pulse was uncountable, and bilious vomiting present.

On abdominal section the mischief was found in the right iliac fossa, where the uterus was fixed to the pelvic brim. Bloody purulent fluid was evacuated after the adhesions were broken down: a glass drainage tube was passed deep into the pelvis, and the wound closed. The pulse soon fell, vomiting ceased at once, and the patient recovered.

ACUTE PERITONITIS; OPERATION AND RECOVERY.

DR. J. W. TAYLOR records (*British Medical Journal*, December 18, 1886) a case of abdominal section for general peritonitis caused by rupture of an abscess of the ovary. The patient was attended during labor (September 29, 1886) by Dr. Phillips, and had forceps applied for uterine inertia. On the third day she had pain in the left iliac region, and up till the end of October had intermittent feverish attacks, with pain and tenderness there. On November 11th she was seized with sudden pain and vomiting. Next day her temperature was 104° F., pulse 100. The abdomen was distended and tender, and an ill-defined swelling could be made out behind the uterus on vaginal examination.

Abdominal section was performed on November 14th, when sero-purulent fluid was found in the abdomen and pelvis. The left uterine appendages, intestines, and omentum were matted, but ultimately the Fallopian tube and ovary were isolated and brought up. The ovary was then found to contain an abscess, which had burst by two ulcerated openings. The tube and ovary were, therefore, removed by ligature, the abdomen well washed out with warm water, and a drainage tube inserted. The patient was convalescent November 28th, temperature and pulse being normal.

FIBROUS POYLPI COMPLICATING THE PUERPERIUM.

In this communication HALLIDAY CROOM mentions briefly the previously recorded cases similar to his, and then narrates two observed by him.

Case I. Patient was first seen with retroverted and enlarged uterus; polypus was suspected. After dilatation with tupelo tents, the base of this polypus was felt, but Croom was unable to remove it. When next seen the patient was six months pregnant, and after spontaneous premature labor there was so much hemorrhage that the inside of the uterus was explored, and a polypus about the size of an orange twisted off from the fundus.

Despite intrauterine injection of corrosive sublimate, the patient died from septicæmia on the sixth day.

Case II. was somewhat similar, except that the labor was normal, and the patient recovered. The recorded cases are 21, grouped as follows:

1. Non-gangrenous, in which a healthy tumor was expelled without any artificial aid	5
2. Gangrenous	6
3. Gangrenous or non-gangrenous removed artificially with hand or instrument	10
Total	21

Budin, in his *Obstétrique et Gynécologie* (1886), records a case where labor was so obstructed, but the tumor was not expelled.

DEATH FROM SUBLIMATE POISONING AFTER TWO VAGINAL INJECTIONS.

Since 1885 corrosive sublimate has been used in the Prag. Obstetric Klinik, under Prof. Breisky's care, but in renal cases, in those with intestinal troubles, and in anæmic and badly nourished women uterine injections of it were not employed. For bathing the external genitals and as a vaginal douche, 1:2000 was the strength of the douche, and if repeatedly used it was diluted to 1:4000. Up to August 28th of this year, according to FLEISCHMANN "Tödliche Sublimatvergiftung nach einer zweimaligen Scheidenausspülung." *Centralbl. für Gynäk.*, No. 47, 1886), 1620 cases were so treated with no bad result until the following:

M. C., seventeen, primipara, had been well during pregnancy with no symptoms of kidney affection. On the first day of her labor, August 28th, the vagina was douched with 1:2000 corrosive sublimate before and after a vaginal examination. Prior to this examination a small quantity of bloody slime had passed from the genitals. After the second douche pain was felt in the lower part of the abdomen with vomiting and diarrhœa. Carbolic douche was now employed and some laudanum given for the diarrhœa. The child was born on the 29th, the vagina being douched with carbolic lotion after the expulsion of the placenta, and catgut sutures applied to the perineal and vestibular tears.

The puerperium was briefly as follows:

August 29th (afternoon). Six fluid motions, salivation, scanty urine.

30th. Gums spongy; grayish-white spots below the tongue; throat congested; urine scanty and albuminous, with hyaline and granular casts, kidney and bladder epithelium, and broken-down red blood-corpuscles.

The diarrhœa and scanty urine continued; tympanites began on the 31st and death from coma occurred on September 5th, eight days after the use of the sublimate.

Post-mortem examination showed acute Bright's disease, dysentery, ulcerated stomatitis and pharyngitis, parenchymatous degeneration of the myocardium and liver, pneumonia, acute cystitis, and imperfect involution of the uterus.

Fleischmann discusses this case and comes to the conclusion that corrosive sublimate poisoning had occurred, the sublimate passing into the circulation through small lesions of the mucous membrane at the internal os. He believes with Thorn (*Volkmann's Samml.*, No. 250) that corrosive sublimate should never be used for vaginal or uterine douching, but only for the skin surfaces of the patient and medical man. Carbolic acid should be employed as a substitute in the former instances.

[This case is certainly exceptional. Mischief might have arisen from carbolic acid. It is probable that the sublimate passed by some mischance directly into the circulation. The fatal injections were given by a midwife, and it is not stated if any forcible dilatation was used.]

THE ORIGIN, DIAGNOSIS, AND SURGICAL TREATMENT OF GENITAL TUBERCULOSIS IN WOMEN.

For some time HEGAR (*Die Enstehung, Diagnose, und chirurgische Behandlung der Genitaltuberculose des Weibes*) had in his castration cases met with instances where the Fallopian tubes contained cheesy matter. Mandach, a Swiss practitioner, had, in 1882 and 1883, removed a tubercular kidney and afterward a tubercular Fallopian tube from a patient successfully, while Czerny had also removed a tubercular tube in a case of tubercular peritonitis.

Hegar had considered his cases as adhesive peritonitis with thickened pus in the tubes, and as a condition following pyosalpinx. The first thing that cast doubt on this idea was the occurrence of pulmonary disease afterward in such a patient: and he, therefore, reconsidered all such from a new etiological standpoint.

In the monograph, Hegar considers the subject of genital tuberculosis with special reference to diagnosis, origin, and treatment by laparotomy when pelvic in women.

The subject is so interesting and valuable that we abstract it fully.

Origin. Tuberculosis does not affect the testicle and ovary so frequently as it does the Fallopian tubes or epididymis. The body of the uterus, the vas deferens, and especially the cervix uteri, are rarely attacked: the vagina is less frequently involved than the uterus and tubes. Friedländer observed an isolated tubercular eruption below a shallow ulcer near the os uteri: nowhere else was there a similar affection. As to the frequency of primary genital tuberculosis, Dr. Mosler found eight out of forty-six instances primary; Frerichs, in ninety-six post-mortem examinations of tubercular bodies, found the sexual organs involved fifteen times, in three of these the affection being primary.

In men, genital tuberculosis, secondary or primary, is more common than in women, so far as one can trust statistics.

Hegar then discusses the question of the latency of genital and peritoneal tuberculosis, pointing out that it may run a slow, chronic course, and may spontaneously cure by caseation or suppuration. Cases of cure of peritoneal tuberculosis are not rare, and have been recorded by Wells, Neumann, and others. In men there is greater opportunity for cure than in women; but, although the Fallopian tube may be perforated, or the disease may spread through the ostium abdominale, it may become encapsuled by adhesion to neighboring organs, more especially to the posterior surface of the uterus or broad ligament.

The tubercular poison may reach the sexual organs either from without or through the body from other previously affected organs. Thus the phthisical sputum, or stool, may pass into the vagina from without, and set up mischief, as in cases where, on post-mortem, one finds lung excavation, ulceration of the bowel and vagina, without disturbance of the rest of the sexual tract.

The extension through the body is well known, and happens as follows: Tubercular affection of the intestine is present, and spreads through the wall of the bowel to the peritoneum, and thus affects the tube. It may pass along its lumen and into the uterus, owing to the ciliated epithelium. The bacilli have been detected in the folds of the fimbriated end by Schramm, the rest of the tube remaining sound.

The tubercular affection may further spread by perforation of a tubercular ulcer of the intestine. In one case the ulcer was rectal, opened into the vagina, and in this way the vagina, uterus, and peritoneum were affected, but not the tube. Most authors consider the blood stream as the usual carrier. In one case, of a five month's pregnancy, where the mother died without abortion, from miliary tuberculosis, no tubercle or bacilli were found at the placental site nor in the fœtus.

In infection from without, the contagion may be conveyed by the finger, by irrigation tubes, etc. Coitus and puerperal conditions also afford opportunities.

Genital tuberculosis is more frequent in adults than in childhood, or after the menopause. Fernet gives four cases of women with primary sexual affection, after association with phthisical men; and, on the other hand, one case of caseous epididymitis in a man with no phthisical heredity, after suspicious intercourse. A case of cystitis (tubercular) after coitus, is also recorded where bacilli were found.

While no case of primary tuberculosis during pregnancy is known, it has often been noted after full time or premature births. This affection may be then acute, death occurring in nineteen to thirty-three days, but is also chronic.

We pass over the account of infection by vaccination, circumcision, instruments of gynecologists, as well as Hegar's comparison to gonorrhœal poison, merely remarking that the bacillary nature of tuberculosis explains such instances, that one can also understand mixed infection (gonorrhœa and tuberculosis) and that the tubercular poison may pass either along the mucous genital tract or by the lymph spaces of the connective tissue.

Diagnosis. The points to be considered in diagnosis are, heredity, the occurrence of infantile affections, and opportunities for infection.

The clinical picture will vary according to the site and extent of the process. We may have colpitis, endometritis, and especially chronic pelvic peritonitis; and, when chronic, we may have secondary nervous symptoms, with painful menstruation, sometimes profuse, sometimes scanty. Increase in temperature may be slight.

Early appearance of marked peritoneal exudation is noteworthy, and lung or bowel tuberculosis occurring with pelvic exudations will awaken the suspicion that the pelvic condition is also tubercular. The *physical* conditions are the most important. In vaginal tuberculosis we have miliary nodules, caseous masses, and ulcers. Detection of the bacilli is necessary to diagnosis. The tuberculous uterus is large, partly from tubercular infiltration, and partly from hyperplasia of its normal elements. Nodular enlargement may be found in the tubes, but the uterine enlargement is usually uniform. The affections of the tubes may be such that they are sausage-like or beaded, the enlargements varying in size from a bean to a walnut. These may blend and give a rounded tumor. The position of the tubes is altered—*i. e.*, they may lie at the side of the uterus, on the posterior or lateral pelvic walls, or in Douglas's pouch. They are seldom in the vesico-uterine pouch. Adhesions may occur altering the above conditions, and binding the tubes to the posterior aspect of the broad ligament.

The appearances given are like tubal dropsies, but on section of the tube in pyosalpinx we do not get circumscribed swellings. In tubercular tubes Hegar could squeeze out caseous, wormy masses, evidently from the tube lymphatics.

The tubercular nodules are, in addition, angular and polygonal, and may vary in consistence. The rest of the pelvic peritoneum (broad ligaments, utero-sacral ligaments) may be thickened and infiltrated, and, of course, we may also have general miliary peritonitis. A second form of tube affection is found where ovaries, tubes, and broad ligaments, and even uterus are matted in one large mass. This condition is difficult to separate from malignant or inflammatory conditions of the pelvic organs, and diagnosis in such instances is not easy.

Treatment. The importance of prophylaxis is evident. The marriage of the phthisical must be forbidden or limited. Phthisical and general patients should not be classed together, and in regard to instruments we must look on tubercular infection as we do on that of wounds. Phthisical sputum and stools must be disinfected, and phthisical nurses should not be allowed to attend puerperæ.

The initial stages of colpitis and endometritis have not been observed as yet, but if detected might be cured by curetting and the use of iodoform.

Extirpation of the uterus *per vaginam*, supravaginal excision of the cervix, removal of the tubes and ovaries, or, finally, mere abdominal section with drainage, are all operative possibilities. We must remember that tubercuculosis is slower than carcinoma uteri, and that operative interference, even if incomplete, may bring about a cure. Removal of the tubes, ovaries, or uterus is indicated when their tubercular affection is primary, and not tending to quiescence. When secondarily affected, they may still be operatively treated if the changes in the other organs are not causing injury, or are yielding to treatment. Fresh tubercular peritonitis is no hindrance to operation.

The contra-indications to operative treatment are advancing disease in other organs, in which the genital disease plays only a secondary part; a greatly run-down condition, and great fixation of the affected organs, which not rarely indicates breaking down. One can, however, in such cases, open the abscesses and cavities.

Vaginal extirpation of the uterus can only be exceptionally practised, but when tubercular affection of the mucosa has not passed too deeply into the wall, we can employ curetting, cauterization, and application of iodoform. When the tubes are also affected, their vaginal extirpation is difficult, owing to uncertainty in the arrest of hemorrhage. Supravaginal amputation of the cervix needs no special remark, and we, therefore, pass on to the question of salpingotomy with castration.

Salpingotomy and castration can be practised when the tubes, ovaries, and neighboring portions of the broad ligaments are involved; when the uterus is simultaneously involved, but gives hopes of yielding to a later intrauterine treatment, or when peritonitis indicating abdominal section is present.

Hegar specially alludes here to the difficulties encountered when dense adhesions are present, and warns against mistaking the surface of the broad ligament affected, penetrating it, and causing bleeding in attempts to enucleate.

The posterior lamina of the broad ligament is the one on which the tubercular tubes and ovaries usually lie.

In one case he treated a fixed uterine adhesion (three centimetres in diameter) by the extraperitoneal method: and, as the other tube had been deep and fixed, and breaking down caseous matter present, with parenchymatous bleeding going on, he penetrated the vaginal roof, and plugged with a long strip of iodoform gauze, bringing the end into the vagina The result was good.

In one case a small tubercular nodule was on the uterine horn and required intraperitoneal ligature. If the uterine cavity is opened, however, one must treat it extraperitoneal. When the broad ligaments are unyielding, the elastic ligature may be necessary.

The opening and evacuation of tubal tumors through the vagina or abdominal walls, with subsequent drainage, injections, etc., may be employed, when the patient's strength and the condition of the other organs permit. The relations here are much as in pyosalpinx. The tube walls are often intact and the cavities closed by adhesions of the fimbriated end. The ostium abdominale may, however, be patent, and the wall of the tube perforated. Thus the contents may escape and set up a septic peritonitis. The tube may, in great part, be destroyed and then the cavity made up of false membranes and the pelvic walls or organs. The tumor may be in the true pelvis or projecting up to the abdominal wall, or separated by omentum and intestine. Seldom is it adherent to the parietal peritoneum.

The operations on such tubercular cavities have been performed by Aran, who punctured per rectum. Hegar has performed salpingectomy and castration in six cases. Mandach has performed it once with a good result.

Hegar's results have been as follows: One patient died; a second was well six months after the operation. A third was well six months after, and was free from pain; had not menstruated. Then the period returned as well as the pain, and suspicious lung symptoms came on. The ultimate result three years after the operation has been good. A fourth case had double pleurisy, apex pneumonia, and other troubles four months after operation, but is now, a year after, in good condition. The fifth and sixth cases gave good results.

The following are some of the cases:

Case I. History of suspicious (tubercular) illnesses in childhood; defective development of the uterus (infantile). Amenorrhœa with menstrual molimina; remains of old pelvic peritonitis; tubes with caseous contents. Castration and salpingectomy. Cure. Tubes and ovaries were found adherent and the former were follicular. The tubes were dilated and caseous, the fimbriated end closed. The diagnosis was based on the pelvic condition, the history, and the lung condition.

Case IV. Phthisis in the family; dysmenorrhœa; attacks of pain, especially during the menses. Primary tuberculosis of the tubes; castration and salpingectomy; discovery of the bacilli.

Case V. Beginning of the disease in childbed with endometritis; swelling of lymphatic glands; menorrhagia. Castration and salpingotomy; recovery. Six months after, pleurisy and lymphatic swellings. Condition good one year after.

TUBAL DISEASE.

A. MARTIN, of Berlin, points out (*Zeitschrift für Geburtshülfe und Gynäk.*, Bd. xiii. Hft. 2) that the chapter on tubal disease is usually one of the shortest in text-books, and one leaving little impression on the reader. These diseases have, however, received attention from several during the last ten years. Hegar, in his classical work on castration, as well as through his pupils, has given his operative experiences. Lawson Tait has vindicated a special *rôle* in the sexual life for the tubes; while Martin and his assistant, Bertram, have published diagnostic and pathological points. Veit has written specially on tubal pregnancy; and Hegar has recently published a special monograph on tuberculosis in the tubes. The special works of Hennig and Bandl must also be taken into account.

Winckel, in 500 cadavera, found the tubes affected in 300. Martin, in 1000 unpicked patients in his Policlinik, found 63 suffering from it, apart from many cases where it was secondary.

Passing over statistics as to age, existence of other pelvic conditions, we note that in 147 cases, chronic or acute, endometric disease was the source of the tubal mischief. 70 times it was in relation to the puerperium, especially that of premature labor.

55 patients were gonorrhœal, 3 had still fresh traces of syphilis, and 10 were tubercular. In 122 cases there were changes in the pelvic peritoneum, ovaries, and broad ligaments, and in 11 the passage of the mischief from tube to peritoneum was traced; in no case was it noted as advancing from peritoneum to tube. In 2 (of the 11) the tube burst; in the others the mischief happened from the passage of fluids into the peritoneum through the ostium abdominale of the tube.

In 91 cases both tubes were affected, in 58 the right only, and in 138 the left only. In regard to the structure of the tube, Martin briefly mentions its mucous membrane, arranged in folds running in the long axis of the tube, and the absence of glands and papillæ. The folding of the mucous membrane is most marked at the abdominal end of the tube. The musculature is most marked at the uterine ends.

The inflammatory processes may be I. *Endo-salpingitis, or catarrhal salpingitis*, II. *Interstitial salpingitis*, and III. *Follicular salpingitis*.

In *endosalpingitis* there is swelling of the folds of the mucous membrane, abundant small-celled infiltration of the mucous membrane, the epithelium remaining intact. The vessels are distended, and ecchymoses are seen here and there.

In *interstitial salpingitis* we have an analogous change in the muscular wall: the tube is of a size varying from that of a lead pencil to that of the little finger. The mucous membrane points at the ostium abdominale.

In *follicular salpingitis* the wall is thickened and enlarged by the presence of what are like cysts on section; the wall seems alveolar and small-celled infiltration with loss of the mucous membrane epithelium is present. Further developments depend on the changes in the muscular walls, in the lumen of the tube, or on the advent of microörganisms. We may thus get distention, muscular hypertrophy, atresia, occlusions of the abdominal end, hydrops tubæ, and so on.

The microörganisms which may infect are those of puerperal sepsis, gonococci, tubercle bacilli, and, in one case, of actinomycosis. The first, Martin believes to be the most common.

In the symptomatology of tubal disease, Martin emphasizes the localization by the patients of the pain in the side of the pelvis, as well as the colicky pains which occasionally end with the escape of fluid from the uterus. Most of the patients complain of profuse pain and irregular menstruation, and have marked disturbance of the general health.

The diagnosis is also made out by palpation, in the way well known to those who practise bimanual examination.

In treatment, Martin points out the value of medicine, especially antiphlogistic remedies, as only one-fifth of his cases required extirpation. Bleeding, rest, energetic action on the bowels, and narcotics during the paroxysms of pain, as well as remedies causing absorption, should be employed. In gonorrhœal cases Martin has used, with good results, unguentum hydrargyri cinerium.

In 72 cases he removed the tubes and ovaries; in 30, both tubes; in 42, one; and in 4 cases he removed first the one and then the other. In most of the cases, adhesions to the ovary and surrounding parts were present, and in some adhesions to the bowel, or even perforation was present. These Martin regards as bad cases, and 3 of his 12 deaths were ascribed to this. In 1, tubercular lung mischief was present, but without tuberculosis in the pyosalpinx. 1 died from cancerous cachexia from primary tubal cancer, 5 died from sepsis, and in 2 the cause of death was unknown.

Martin does not wash out the peritoneum unless he cannot help it, and taps the distended tubes before separating them.

He usually closes the wound fully, or drains either through the vagina or in such a way as to close off the portion requiring drainage from the rest of the peritoneal cavity.

THE DIAGNOSIS OF COMMENCING CANCER OF THE PORTIO.

STRATZ (*Zeitschrift für Geb. und Gynäk.*, Bd. xiii. Heft 1) points out that the operative methods of the treatment of malignant disease of the uterus have so far been tested by time, and we can now say with certainty that carcinoma is curable. Already have cases been recorded where women have enjoyed eight years of undisturbed health after operation.

There is further quite a series of cases of special interest where, on *post-mortem* examination some years after operation, no traces of uterine cancer were found, while often in the ovary, pelvic connective tissue, etc., carcinomatous disease had established itself. One special case where Schröder had performed supravaginal amputation, had, on subsequent section, the scar and uterine remains free, but the whole pelvis filled with malignant masses.

Stratz believes, therefore, that cancer is curable, and that the earlier the operation the better the result. He deprecates palliative treatment as only rendering radical treatment impossible, and condemns those who hold cancer incurable. It is of the utmost importance, therefore, to diagnosticate carcinoma early, and subject it to prompt radical treatment.

He points out, however, that the early symptoms of cancer are so slight that women consult a specialist too late. The family physician has the opportunity of being consulted early, and has the opportunity, therefore, of seeing the initial symptoms, such as increase in the menstrual flow, slight pains, and so on. A specially frequent and well-known symptom is bleeding after coitus. When for such symptoms one can exclude external influences, the question of cancer as their source must be considered.

The early physical signs of carcinoma are not well marked, and it may be impossible to diagnosticate early malignant disease without microscopic examination of the suspicious tissue. Ruge and Veit have shown that one can only suspect beginning cancer from symptoms: this suspicion can be established by microscopic investigation.

Stratz records some cases of early carcinoma, points out the difficulty of diagnosis by the naked eye, and concludes that the important signs of early malignant disease of the cervix are: 1. The affected portion separates sharply from the sound tissue. 2. One can see a difference in the plane of the affected as compared with the sound tissue. 3. The cancerous portions have a yellowish tinge. 4. The malignant parts are usually small, nodular, whitish-yellow prominences.

ON ONE-SIDED HYPERTROPHY OF THE VAGINAL PORTION OF THE CERVIX.

The hypertrophies of the supravaginal and middle portions of the cervix are believed to be brought about by traction exerted on these by prolapse in the vaginal wall. On the other hand, the hypertrophy of the vaginal portion is not evident, and has been attributed to the irritation of pessaries, to masturbation, or circulatory disturbances.

One certain fact is that we get hypertrophy of the vaginal portion as the only form in nulliparæ, while in parous women, and in the chronic metritis of nulliparæ, the portio vaginalis is small; in the parous it is large. The hypertrophic processes are either simple or follicular; in the former all the elements of the cervix are involved, in the latter, chiefly the mucous membrane. Partial hypertrophies are associated with cervical laceration. Of such hypertrophies, that of the anterior lip is the most common, the posterior lip following next, and the lateral hypertrophies last. Simple partial hypertrophies are, therefore, associated with lacerations brought about by labor. Follicular hypertrophy may exist in nulliparæ, and is related, doubtless, to ectropion, is always partial, and is not so evidently associated with a preceding labor. Symmetrical follicular hypertrophy has not yet been observed.

STRATZ (*Ueber einseitige Hypertrophie des untern Cervicalabschnitts*) takes up more especially one-sided hypertrophies. The only cases of any size are recorded by Cazeau, Tarnier, and Huguier. Three cases are given by Stratz.

MENSTRUATION IN MONKEYS.

MR. BLAND SUTTON (*Brit. Gynec. Journal*, November, 1886) first considers menstruation in the human female. From an examination of the uteri of young females during gestation he has come to the conclusion that during menstruation only the epithelium of the uterus passes away; this is accompanied with blood and mucus. He criticises Dr. Williams's view on the question; but it is important to note, however, that Mr. Sutton does not define the mucous membrane of the uterus as Dr. Williams does, and that he makes no reference to the elaborate papers of Kundrat and Engelmann and Leopold. Dr. Williams includes the muscular fibre of the uterus in the term mucous membrane, and believes that the mucous membrane down to it—*i. e.*, the glandular mucous membrane—is removed. This is a superficial removal only when we consider his definition. The view advanced by Sutton differs little from that given by Leopold.

In Macaque monkeys and baboons during menstruation Sutton has been able to show that the epithelial lining of the uterus is not shed, and that the amount of blood escaping is small.

MEDICAL JURISPRUDENCE AND TOXICOLOGY.

UNDER THE CHARGE OF

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Prophylaxis of Hydrophobia.

Pasteur has recently (November, 1886) communicated to the *Académie des Sciences* the results of the employment of his much heard of method during the one year which has elapsed since he gave his first communication to the Académie on October 26, 1885. 2490 persons, supposed to have been bitten by mad dogs, were treated by his method during that period. The treatment of each was uniform, lasting always for ten days, during which a daily injection of infusion of spinal cord of a rabbit was made, beginning with a cord of fourteen days' exposure, and ending with one of five days. He classifies the patients according to their nationality. It is interesting to note that while, as was to be expected, the majority (about two-thirds) were French, 80 were English, 21 American, and many came from the remotest parts of Europe. Out of the 1726 French and Algerian cases, 10 were unsuccessful, the patients afterward dying of hydrophobia. This is equal to a mortality of 1 in 172. During the five years preceding November, 1885, the number of deaths from hydrophobia in the hospitals of Paris was, on an average, 12 a year. During the year ending November, 1886, there have been only 3 deaths, and in 2 of these the patient had not previously been treated by Pasteur's method. Pasteur believes that these results are strongly confirmatory of the utility of his method.

He has found it necessary to modify his method in the case of patients bitten on the face or head, or bitten very severely elsewhere, especially if the parts were naked. This he does by passing more rapidly than usual, and with omissions, through the injection of the graded cords, until a spinal cord of one day old is used.

Finally, in order to meet the objection which has been raised to the experiments on dogs, on which his method is based, that the dogs were inoculated *before* being bitten, whereas men are inoculated *after* they are bitten, Pasteur has made some fresh experiments on dogs in which he practised intracranial injection with fresh unmitigated virus, and then inoculated the animals some time afterward in the usual way. These experiments were evidently not very successful, hydrophobia appearing in most of them. Pasteur concludes with the remark that the immunity conferred by inoculation previous to infection offers the best proof of the excellence of the method.

Pharmacological and Toxicological Study of Digitalin.

Lafon (*Annal. d'hygiène Publique*, sér. 3, tom. xvi. pp. 429–444, and 506–519) begins with a comparison of the physical and chemical characters of the different commercial varieties of digitalin. These are chiefly the crystallized digitalin of Nativelle, the amorphous digitalin of Homolle and Duquesnel, and the crystallized and amorphous digitalins of Germany (Merck). The German varieties are fairly soluble in water, while the others are very slightly soluble. In chloroform the latter are more soluble than the former, which are insoluble. Further, the latter do not yield the author's reaction (*vide* this journal, 1886, p. 345) with sulphuric acid and perchloride of iron, while the former do. Further comparison leads to the conclusion that all the French varieties of crystallized digitalin are identical in their physical and chemical properties; that the amorphous digitalin of Homolle and Quèvenne is nearly identical with the digitoxin of the Germans, and resembles the French digitalins in its chemical properties, though considerably differing from them in its fusion point; and that the German digitalin differs from the French digitalin in many of its chemical properties.

In the next place, the author proceeds to prescribe a method of separating the digitalin in a case of poisoning by it. He says Stas's, Otto's, and Dragendorff's methods readily allow of the separation of the digitalin, but not in a very pure form. And as the purity of the separated digitalin is of great importance in the application of the author's color reaction, he describes a modified process by which the digitalin can be obtained in a purer form than is usual. The material supposed to contain the digitalin is to be thoroughly extracted with hot alcohol, then filtered; and the filtrate evaporated until nearly all the alcohol is driven off. An abundant precipitate forms in the aqueous residue, which is separated by filtration through glass wool. Subacetate of lead is now added to the filtrate, which is again filtered. The filtrate is next treated with sulphuric acid to remove the excess of lead, and is once more filtered. The filtrate is now shaken with chloroform, which removes the digitalin in a very pure form, and which, after the evaporation of the chloroform, can be employed for the author's reaction. By such a proceeding the author has been able to detect 1 mgrm. (0.015 grain) in 200 c. cm. of urine, and 3 to 4 mgrms. in vomits, soups, blood, etc.

The next portion of the author's communication is devoted to experiments on the action of digitalin on dogs, given *per os*, subcutaneously, and intravenously. Homolle and Quèvenne's digitalin appears to have been used in all these experiments (which are twenty-five in number) except in one or two, in which digitalis powder was employed. The experiments were mainly directed toward ascertaining to what extent the digitalin could be afterward detected in the body. His conclusions in this respect are (1) where small poisonous doses have been given *per os*, no trace of digitalin is discoverable in the urine, blood, liver, kidneys, lungs, brain, etc. But if the dose is over 10 centigrammes (1½ grains), and vomiting has not occurred, the poison can be detected within the body: (2) the digitalin is most easily found in the contents of the stomach or intestines (or in the vomit); (3) after poisoning *per os* by small doses, digitalin cannot be detected in the internal organs of an animal which has been buried for some time (six to seven months) (4) after poisoning by subcutaneous injection, the digitalin is not to be found anywhere unless in the muscles in the vicinity of the seat of injection; (5) after poisoning by intravenous injection, the digitalin cannot be detected unless the animal dies, or is killed, within ten to twenty minutes after the injection.

With regard to the relative toxicity of the various kinds of digitalin when administered subcutaneously, the author finds that (1) the various crystalline digitalins (Nativelle's, Duquesnel's, Homolle and Quèvenne's, Mialhe's) have nearly the same activity—about two milligrammes per kilogramme of body weight being sufficient to kill a dog; (2) the so-called "digitalin chloroformique" (Codex) of Homolle and Quèvenne possesses the same toxicity as the foregoing; (3) that the German digitoxin, although considered more active than these others, is not so, and possesses about the same activity.

As to the elimination of digitalin from the organism, the results of the author's experiments appear to point to its more or less complete destruction within the body. It is only found in the urine when very large doses have been administered, even though injected intravenously. In the case of two patients who were receiving 40 centigrammes (6 grains) daily of digitalis leaves in the form of an infusion, no digitalin could be detected in the urine. But if 40 centigrammes of digitalis were digested with urine, the digitalin could afterward be readily separated and recognized.

With reference to the supposed accumulation of digitalin within the body after repeated doses of it, the author was not able to find any confirmation of this supposition.

The author finally investigated the resistance of digitalin to the action of diastase, pepsine, pancreatic juice, bile, mineral acids, caustic alkalies, yeast ferment, and emulsine, as also to the action of putrefaction, and found that the digitalin was little affected. He therefore infers that it is not decomposed in the alimentary canal, but is probably much transformed in the blood.

Accidental Poisoning from the Use of Subnitrate of Bismuth in Surgical Dressings.

Dalché, of the Hotel Dieu, reports two such cases in the *Annales d'hygiène Publique* (sér. 3, tom. xvi. pp. 358–361). The first is that of a woman who was admitted to the hospital with a very extensive burn over the back and left arm. It was dressed with subnitrate of bismuth, the dressing being renewed every two days. About a fortnight after the commencement of the treatment the patient began to complain of slight pain in the throat, accompanied by dysphagia. On the under surface of the soft palate a white false membrane was observed, which extended to the tonsils. In two days the membrane became more extended, and was covered with a blackish mucus. A small patch of membrane was also noticed on the lower lip. The breath became fetid, and the false membranes gradually became detached and loose, but with the formation of new membranes in other parts of the throat and mouth. A few days later diarrhœa, and afterward vomiting, set in. The bismuth dressing was now stopped. The preparation used was found to be absolutely pure, and the presence of bismuth was detected in the feces and the urine. Albumen was also found in the urine. The vomiting and diarrhœa continued for two or three days after the stoppage of the bismuth. But the other symptoms of bismuth poisoning did not entirely disappear until after a month.

The other case was that of a young, thin, anæmic girl, whose knee had been excised and the wound dressed with the subnitrate. A fortnight after the operation, without elevation of temperature, the patient lost her appetite, was salivated, and presented all the symptoms of stomatitis. Bismuth was found in the urine. The course of this case was similar to that of the first.

The author quotes Rabuteau as saying that Dubinsky found "that bismuth, which is largely eliminated in the saliva, produces in the buccal mucous membranes effects which are similar to those of mercury." The author appears to be unaware of Steinfeld's recent investigation of the action of the salts of bismuth.

The New Mortuary in Berlin.

Prof. Liman (*Viertelj. f. gerichtl. Med.*, N. F., Bd. xlv. S. 170–178) gives a description, with plans, of the new mortuary which has just been completed in Berlin. It is a large horseshoe-shaped building, fifty-six metres long, and nineteen metres broad. It has been constructed with three objects in view: (1) To supply an ordinary police mortuary, for the laying out and identification of such dead bodies as come into the possession of the police; (2) to provide accommodation for the complete medical examination of the bodies in needful cases; and (3) for the teaching of medical jurisprudence. The central part of the building is devoted almost entirely to meeting the first of these objects. Besides cellars for holding identified bodies, there are seven small chambers for the exhibition of unidentified bodies, two in each. These chambers are lighted from above, and lie along a public corridor, from which they are separated, as well as from each other, by a glass partition. The temperature in these chambers and in the cellars is kept at 0° to 2° C. by means of copper pipes in which a solution of calcic chloride circulates, the solution being cooled by an ammonia ice machine in an adjacent cellar. On the same level as these chambers are two large rooms, one for washing the bodies and another for depositing the bodies after they are coffined. Conveniently near is a small chapel, where funeral obsequies may be performed in connection with bodies about to be removed for burial. A hydraulic elevator, capable of lifting three hundred kilos., is used for lifting bodies from one story of the building to another. The right wing of the building consists of two stories, one of which is devoted to the medico-legal examination of bodies, and the other to arrangements for teaching. In the former there is a commodious autopsy room, with two tables, two chemical laboratories, two private rooms for the physicians, a room for the crown officer, and a small waiting-room for the witnesses required to identify the bodies; in the latter, which is placed above the other, there is another autopsy room for purely teaching purposes, a lecture-room, a museum, a small library, and private rooms for the director of the institute and his assistant. The left wing of the building is mainly devoted to providing accommodation for servants. It also contains a telegraph office. The building, altogether, appears to be well planned, and might form a model for similar institutions in other towns.

Hanging in Hot Countries.

Pellereau, of Mauritius, gives an interesting account of hanging in tropical climates (*Annal. d'hyg. Publ.*, sér. 3, tom. xvi. pp. 108–125, 1886). Accidental or homicidal hanging is rare, just as in colder countries. Hanging is nearly always suicidal, and is the mode of death most frequently resorted to by suicides. In Port Louis (population, 60,000) fifty cases of suicidal hanging occurred in six years (1878–1883). This mode of suicide is in favor, especially among the inferior classes of the population, the Creoles and Indians. The better classes, and the Chinese in Mauritius, have recourse more frequently to firearms or poison. Hanging is more common among the men than the women. The author has frequently been present at cases of judicial hanging, and has carefully observed the appearances at death and at the autopsy. The phenomena he divides into three successive groups or stages: first, a short period of immobility; second, a period of tetanic rigidity; and third, a period of clonic convulsions. Altogether they do not extend over more than two or three to five minutes. The onset of cadaveric rigidity is somewhat retarded. The post-mortem appearances are, in general, similar to those seen in other countries. In answering the question whether the hanging, in a doubtful case, has taken place during life, the author lays stress on swelling and lividity of the face; tongue between the teeth, enlarged and excoriated; excoriations on the superior and inferior extremities; evacuation of semen; staining of the scrotum and buttocks with urine and feces; mark of the cord; congestion of the brain and its envelopes; congestion of the larynx, trachea, bronchi, and lungs; congestion of the jejunum, ileum, and kidneys; dislocation of the atlas. These appearances may be all present in one case. Sometimes they are nearly all absent. In such a case the trickling out of the saliva from the mouth, and the presence of fragments of food in the larynx, trachea, bronchi, and œsophagus, as also the existence of petechiæ on the inferior extremities, and collapse of the lungs, may be looked for.

PUBLIC HEALTH.

UNDER THE CHARGE OF

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Recent Prevalence of Cholera in Europe.

Dr. Buchanan, F.R.S. the Medical Officer of the Local Government Board of England, has presented to his Board a report, giving (1) account of the prevalence of cholera in Europe in 1884 and 1885; (2) account of the International Conference which was held at Rome; (3) abstract reports on the condition of English ports and other districts in relation to their security against cholera; (4) some recent researches into the pathology of cholera. The first subject only can be referred to in this number.

An important part of the report on cholera prevalence is a statement by Dr. Thorne of the behavior of this disease in different European countries. Much care has been taken to make this as complete as possible, but at the time of its preparation the French Government had not issued their official report, except so far as relates to Paris.

(1884) In France the disease first appeared at Toulon, when, on June 23, 1884, it was announced that fourteen deaths had taken place. The disease was soon recognized to be epidemic cholera, but some doubt still remains as to the means by which it was introduced. In the first instance it was supposed to have been conveyed by the "Sarthe," a French transport which had recently returned from Cochin China, two cases of the disease having occurred on April 1 and 2, 1884, while the vessel was at Saigon; but it was ascertained that the patients were set ashore, the vessel disinfected, and no other cases occurred during the subsequent forty-five days that the vessel took to reach Toulon. Search was therefore made for other means of introduction of the disease, when it was found that other transports returning from China had also had cases of cholera on board. A considerable exodus from Toulon took place, the disease rapidly extended to Marseilles, and speedily increased in these two cities, the public press returning somewhat over 880 fatal attacks in Toulon, and not very far from 2000 in Marseilles. Monsieur Guérard, an engineer, says that the most neglected portions of the town of Marseilles in point of cleanliness were those which were most fatally affected.

As cholera diminished in the south of France, it manifested itself in the north, beginning at Yport, a small fishing village on the coast of Normandy, where the disease was imported by the arrival, on September 28, of two of the crew of the "Louise Marie" from the port of Cette. An interesting account by Dr. Guibert, of Havre, supplies material which enables the diffusion of the disease in this town to be understood.

By November 1 the town of Nantes had been invaded, and a few days later deaths from cholera occurred in Paris, altogether 938 persons dying in the latter city. The total number of deaths known to have occurred during 1884 in France amounts to some 5000.

In Italy considerable precautions were taken by the government to prevent the introduction of disease into that country; they were of the usual quarantine kind, and are described by Dr. Thorne at some length. Among these precautions was the removal from Toulon of Italian operatives in a vessel especially sent for the purpose, these people being detained in quarantine before being allowed to land at any Italian port. Nevertheless, one Italian workman returning from that city, and after having undergone the required quarantine, developed cholera at Spezia, and other deaths occurred among the soldiers forming the sanitary cordon round the village of Pancalieri at the foot of Monte Viso, where some Italian workmen from Toulon had been taken ill. In the meantime cholera had appeared in Cuneo on June 28th, Livorno on July 14th, Porto Maurizio on July 17th, Genoa on July 19th, and Turin on July 20th. The disease rapidly spread, and reached Naples by August 27th.

With a view to confining the disease in Spezia, there were provided a military cordon on shore, and a maritime cordon in the bay, supported by gunboats, but it was largely evaded, and it is stated that within two days of the official announcement of the epidemic in Spezia, no less than six thousand of the inhabitants fled from the place. In September there was a great increase in the severity of the epidemic and in its diffusion, numerous deaths occurring in the province and city of Genoa, in the provinces of Parma, Bergamo, Cuneo, Massa, Carrara, and Caserta.

In the city of Genoa cholera was attributed, according to local correspondents, to the use of polluted water supplied by the aqueduct of the Nicolai

Society, the source of which is near Busalla, where cholera had been very prevalent, and in this water it is stated the clothes of cholera patients had been washed. The municipality ordered the Nicolai Society to discontinue the supply of this water.

Rome remained free, but the disease extended to the Adriatic provinces of Rovigo and Ferrara, and outbreaks occurred in some of the more scattered portions of the peninsula, a single death also occurring in Palermo.

In Naples the disease manifested itself with the greatest severity, by the end of September 5700 cholera deaths having taken place in the city, in addition to 520 deaths in other parts of the province. The disease is believed to have been introduced into Naples by Sicilian workmen from Marseilles who, after having been subjected to quarantine, arrived in Naples on August 3d, and took up their quarters in the Porto district, of which the sanitary circumstances were most defective. They were subsequently removed to a floating lazaretto, but it is believed the removal came too late, for two days afterward the first case of cholera occurred in the city. The four districts of the city most severely affected were those notoriously the most unhealthy and filthy.

The epidemic in Italy was maintained up to the middle of October, but terminated at the end of that month. The total fatality of the disease in that country, judged from the various sources to which Dr. Thorne had access, being 11,500 persons; but this number, Dr. Thorne remarks, falls short of the actual mortality from this disease, which, according to a report of the Ministry of the Interior at Rome, caused a total of 27,030 cases, and 14,299 deaths.

In Spain, where quarantine regulations were strictly enforced, cholera also made its appearance, invading first Novelda and Monforte, two inland towns in the Mediterranean province of Alicante, where deaths occurred late in August or early in September. Subsequently Elche, in the same province, was attacked, and on the 18th of September cholera appeared in the coast town of Alicante. There is reason, however, for believing this port to have been invaded at an earlier date, the disease being imported by a vessel from Algiers, which had amongst its passengers a family from Cette, who took up their abode in a house where cases of cholera subsequently appeared.

The disease thus spread in the provinces of Alicante, Tarragona, and Lerida, and at the end of November deaths were recorded in Toledo and in the coast province of Valencia, and finally, in December, four deaths occurred at Vergel, close to the northern boundary of the province of Alicante. In all, intelligence was received of 274 cholera deaths in Spain during 1884.

In England, in 1884, on three occasions ships arrived with cases of cholera on board, or with persons who were convalescent from attacks of cholera; the sufferers were in each instance removed to hospital, and there was no subsequent case of cholera on shore.

(1885) During the following year (1885), in the beginning of June, cholera was publicly announced to be prevailing in Spain, the cases being situated in Castellon, Valencia, and Mercia, and a few cases in Madrid, the three coast provinces neighboring to that of Alicante, which suffered from the disease in 1884. Before this announcement, however, it was known that a dangerous epidemic of some sort prevailed at Xativa, in the province of Valencia, and that there were other cases in the southwest portion of the same province.

Portugal and France, moreover, had declared Spain to be infected, and quarantine measures were imposed. During June the disease spread rapidly in each of the above provinces, attacking a number of cities, including the cities of Cienpozuelos, Cartagena, Saragossa, Aranjuez, Cuença, and Toledo, and the provinces of Huesca, Saragossa, Cuença, Alicante, Toledo, and Teruel.

During July the epidemic increased both in severity and in the area of its diffusion, and in August the infected area included further the provinces of Gerona, Navarre, Logrono, Burgos, and Palencia to the north, Almeria to the extreme south, Salamanca on the west, and Valladolid and Guadalajara toward the centre of the kingdom. The month of September exhibited a considerable decrease in the intensity of the epidemic, but Dr. Thorne observes that the extent and suddenness of the decrease cannot have been anything like as great as would appear from the published statistics.

Altogether 338,685 cases were reported, and 119,620 deaths. Of the large Spanish towns Aranjuez was by far the most severely stricken. Within only one month 19.8 per cent. of the nominal population suffered, and 10.1 per cent. died of cholera.

Gibraltar had altogether 34 cases, and 25 deaths; the disease, according to Surgeon-Major Staples, resembling in its incidence the epidemic of 1865, the poor quarters being mainly attacked, where impurity of air from overcrowding, faulty sanitary circumstances, the impurity of drinking water, and unwholesome food supplies were associated with its prevalence.

It is noteworthy that with a population of some 24,000 persons the cholera deaths in Gibraltar amounted to 23, whereas in the neighboring Spanish town of Linea, with only about half as large a population, no less than 194 fatal attacks occurred.

The necessity of bringing food supplies from Linea into Gibraltar, which is entered daily by some 4000 persons from Spain, rendered it impossible to prevent communication between these two places, and no measures of land quarantine or other restrictions on the movements of the population were attempted.

In 1886 the disease lingered during the first few months at Algeciras, in the province of Malaga and at Tarifa.

In France, in 1885, there was no record of cholera until August 2d, when 12 fatal attacks were reported in Marseilles. From this date the disease rapidly extended, lasting until the middle of September, and causing 1039 deaths. In Toulon a fatal case occurred on August 8th, and subsequent cases were reported even as late as October, making a total of 314 deaths.

During October, 1885, deaths from a disease resembling cholera were reported as having occurred in the department of Finisterre, in November three cholera deaths were reported from the Pyrénées Orientales, and early in the same month the disease also appeared in the neighborhood of Quemper, being apparently introduced into this district from Toulon by the arrival of seamen on furlough from war ships or transports from Tonquin.

In Italy, in 1885, a few cases of cholera occurred at Gaëta in January, and from that time till August 1st no cases are known to have occurred. In this month cases were reported in the following provinces: Naples, Massa, Genoa, Cremona, Porto Maurizio, Venice, Parma, Piacenza, Alessandria, Modena, and Caserta. On September 6th cholera appeared in Palermo, the capital of

Sicily, causing a serious mortality during that month, but diminishing during October. The epidemic occasioned 2287 deaths, while in the rest of the province of Palermo further deaths to the number of 672 occurred, a smaller number of deaths taking place in other parts of the island. During September other Italian provinces were invaded, in the majority the outbreaks being trivial; but in the provinces of Reggio Emilia, Rovigo, and Ferrara they were more serious. The official report issued by the Minister of the Interior gives account of 6397 attacks, and 3459 deaths among the inhabitants of Italy during 1885.

In the latter part of the year the disease subsided, and from the end of October until December 23 no further intelligence was forthcoming; but at that date a few cases occurred in the city of Venice, and others in the rest of the province.

(1886) For the first three months of 1886 there was no information of cholera in Italy, but in the beginning of April cases were reported on the coast at Brindisi and Manopoli, others during the month occurring in the surrounding country. Again, a few cases were reported on May 1 in Venice, and the mortality continued until the close of May, when there had been 276 cases and 151 deaths in this place.

England remained free from cholera during 1885 and 1886, but in a few instances vessels arriving from foreign infected ports, having had on board deaths from cholera or diarrhœa, were dealt with under the cholera order of 1883.

Dr. Buchanan notes that Dr. Thorne "gives some instructive and significant illustrations of the relation between filth and our present cholera epidemic; he further shows that each country which had been invaded received the disease by its littoral provinces, and he tells how countries which profess to take strict quarantine precautions have suffered; some very severely, and others (it would seem) not at all, the latter resembling in this respect our own country, which imposes no quarantine whatever against cholera upon any of the multitude of vessels which reach its shores from the infected countries."

Account will be given of the other subjects in the report in the next number of this journal.

RECENT INOCULATIONS OF SMALLPOX VIRUS.

The *Gazette Médicale de Nantes* relates the history of smallpox from which the inhabitants of Tanganika suffered so long. Whole villages were destroyed by this terrible disease, and though lymph had several times been brought from Europe, it had always failed to produce any result in those vaccinated. At last it was determined to try inoculation with smallpox matter. Five hundred persons were inoculated; of these none died, the majority had three pustules at the site of inoculation, some had two, or even one pustule, but all had fever, a few somewhat severely. The material for inoculation was taken from a smallpox patient, a child who had an attack of discrete variola, and the lymph from its pustules was inoculated into all who came. The same happened in other towns; in only one case did the person die after being inoculated, and he was, probably, incubating smallpox at the time of the operation. In one village, in forty-eight hours, over five hundred were inoculated, and since that time only four persons in that village have died from variola, none of them being willing to submit to inoculation.—*Journal d'Hygiène*, vol. ii., No. 529.

INSPECTION OF MEAT IN PARIS.

In Paris the police are charged with the duty of regulating the sale of meat, and inspecting all meat sold within the city. The law which is concerned with the suppression of fraud with regard to provisions was passed in 1851, but the decree of the prefect of police of 1879 is that under which the police act for the seizing and condemning of meat. There are 57 inspectors, and before they can be admitted they must pass an examination on some veterinary subject, and also a practical examination at a slaughter-house in Paris. No butcher's meat or pork, fresh, salted, or smoked, may enter Paris without previously being inspected, save in very small quantities. The meat must only enter by certain gates, or during certain hours; all meat found to be unfit for consumption is seized at once and destroyed at the expense of the owner, except when he requires it to be returned to him for industrial purposes, it is then sprinkled with oil of turpentine, or some other chemical, to prevent its being used for food. It is sold to horse-killers when quite unfit for food, but when only contaminated it is handed to the guardians of the Jardin des Plantes for the use of the animals. Other provisions, also, undergo a rigorous inspection under the same law, but by a different class of inspectors, who report to the Municipal Laboratory of Chemistry. There are twenty inspectors, and two are attached to each of the ten sections of the city. They examine provisions in the markets and in the shops, and they are also provided with a microscope and reagents for testing. If the goods are really bad they are destroyed at once; if only adulterated they are analyzed, and the owners punished by fines, or even imprisonment. The inspectors report every day, and record all the work performed in each section of the city.—*British Medical Journal*, January 8, 1887.

THE ETIOLOGY OF "CHARBON," AND THE DRAINAGE OF MARSH LAND.

MESSIEURS BOULEY and RAYNAL, in their *Dictionary of Veterinary Medicine*, give their views with regard to charbon.

In countries where marshes occupy a large surface, charbon is most often observed, also in places exposed to inundations, or where there is much stagnant water: and again, this disease produces the greatest ravages where the drinking water is brackish.

Thus, the Sologne, a plateau in the department of the Loiret, Loir et Cher, and Cher, is the chief of the marsh lands of France; it consists of vast ponds and valleys where it is difficult for the water to flow away, and which are easily transformed into marshes during the heat of the summer. Next in order come the departments bordering on the sea, also the marshes of the Dombe, La Bresse, and Breime.

Again, charbon is known, not only in France, but in other countries of Europe which have marsh land. M. Verheyen says it is enzootic in Esthonia, Livonia, and Courland; also in Poland and several districts of Germany. Charbon, he remarks, appears every year, and by preference attacks those animals which live in fields near the mouth of rivers, or where the ground is swampy.

In Spain charbon is enzootic in valleys which are under water at certain times, and in Siberia where there are innumerable lakes and swamps, the animals are decimated every year by "jaswa," or a charbon fever, which, in one year, killed about 100,000 horses.

The method adopted in many countries to counteract the influence of the marshes is to remove all flocks and herds to high plateaus in the mountains at the beginning of summer. It is well known that the soil of marshes is generally flint-clay, not permeable to the stagnant water, which covers its surface; they are, moreover, always more or less muddy, smelling most unpleasantly, and containing a number of aquatic plants, and much infusorial life; besides this, all marshes exhale carbonic acid and sulphuretted hydrogen.

The miasma produced is dependent upon the temperature, and thus during the months of July, August, and September, the marsh lands are the most unhealthy, and charbon is most likely to appear. When the bottom of the marsh is neither completely submerged nor completely dry, fermentation is easily induced, the conditions most favorable for the development of charbon result, and a septic substance is introduced into animals which either produces charbon, or some allied disease.—*Journal d'Hygiène*, vol. ii., No. 533.

Red Cod.

In a report addressed by Dr. Heckel, of Marseilles, to the Ministre de la Marine (*Journal d'Hygiène*, vol. xi. No. 521, p. 462), he states that the loss to the fisheries and fish merchants by the prohibition of the use of "*red*" cod amounts to at least twenty million francs, and he has, after careful consideration, come to the conclusion that the red cod is not always poisonous, indeed it is so very rarely; it may become red without being poisonous, and he believes that the red color of the cod is due to a species of fungus. A Spanish newspaper, the *Imparcial*, of March, 1886, gives an account of the discovery in 1878, in the United States, of a red fungus in dried cod, which was ascribed by the commercial world to the use of Mediterranean salt for preserving. In 1884, Algiers seems to have suffered from the same disease, and the same year Bérenger Férand stated that in Lorient 200 men out of 380 on board the "Vengeance" had been attacked after eating dried red codfish. The symptoms were the same as after partaking of any decomposed article of food—serious disturbance of the digestive apparatus and more or less disturbance of the nervous system. It is supposed to be due to a poisonous alkaloid, "ptomaine."

Several other accounts have been given of this poison or species of rust which is found in dried codfish, amongst them is a publication by Drs. Layet, Artyales, and Ferré, of Bordeaux. They say that on the surface of dried codfish, affected in this manner, and between the muscles on the surface are organisms of a vegetable character which cause this reddish coloring. They take the form of "sarcinæ." They are found in heaps together with a granular substance, formed from remnants of tissue: they are most numerous near the crystals of salt, and they seem to penetrate with the salt in between the muscles and decompose the tissue.—*Deutsche Vierteljahrsschrift f. öff. Gesundheitspfleg.*, Bd. 18, No. 4, S. 633.

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